

# **Engineering Evaluation/ Cost Analysis for the 100-K Area Ancillary Facilities**



United States  
Department of Energy

For External Review

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# **Engineering Evaluation/Cost Analysis for the 100-K Area Ancillary Facilities**

September 2004



**United States Department of Energy**

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P.O. Box 550, Richland, Washington 99352

## EXECUTIVE SUMMARY

This document presents the results of an evaluation of three removal action alternatives for disposition of 27 support buildings in the 100-K Area of the Hanford Site. The buildings (ancillary facilities) are currently inactive, and the U.S. Department of Energy, Richland Operations Office has determined there is no further use for them. Hazardous substances in these facilities present a potential threat to human health and the environment to the extent that action is warranted for the facilities. The lead regulatory agency, the U.S. Environmental Protection Agency, has determined that a non-time-critical removal action is appropriate to mitigate the potential hazards present in the 100-K Area ancillary facilities. An action memorandum, which will be developed from this engineering evaluation/cost analysis, will document and authorize implementation of the removal action that is selected for the facilities.

This document briefly describes the 100-K Area ancillary facilities, site conditions, and the sources and extent of contamination to provide a framework for the discussion of removal action objectives and alternatives. Finally, each removal action alternative is compared against the criteria of effectiveness, implementability, and cost.

Removal actions evaluated for the 100-K Area ancillary facilities include (1) no action, (2) deactivation followed by decontamination and decommissioning (D&D), and (3) long-term surveillance and maintenance. The no action alternative assumes all short-term and long-term maintenance of the facilities is terminated and the facilities are locked to prevent entry. The deactivation/D&D alternative consists of immediate deactivation of the facilities followed by D&D and associated waste disposal of the contaminated debris. The long-term surveillance and maintenance alternative includes an extended period of facility monitoring with major and minor repairs as necessary followed by eventual decontamination and demolition of the facilities.



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**Executive Summary**

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Current-year and present-worth cost estimates for the three alternatives are shown in Table ES-1. Consistent with guidance established by the U.S. Environmental Protection Agency and the U.S. Office of Management and Budget, present-worth analysis is included as a basis for comparing costs of cleanup alternatives under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* program (EPA 1993).

**Table ES-1. Cost Comparison for Removal Action Alternatives  
for the 100-K Area Ancillary Facilities.**

Alternative	Current-Year Cost	Present-Worth Cost
Alternative 1 – No Action	No cost	No cost
Alternative 2 – Deactivation/D&D	\$27,700,000	\$25,530,000
Alternative 3 – Long-Term Surveillance and Maintenance	\$36,800,000	\$16,190,000

The recommended removal action alternative for the 100-K Area ancillary facilities is deactivation followed by D&D. This alternative is recommended based on its overall ability to protect human health and the environment and its effectiveness in maintaining protection for both the short term and the long term. The alternative would also reduce the potential for a release by reducing the inventory of contaminants. This alternative provides the best balance of protecting human health and the environment, protecting workers, meeting the removal action objectives, achieving cost effectiveness, and providing an end state that is consistent with future cleanup actions and commitments to the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1998).

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## ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	<i>Code of Federal Regulations</i>
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DQO	data quality objective
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant difference
FR	<i>Federal Register</i>
NEPA	<i>National Environmental Policy Act of 1969</i>
NHPA	<i>National Historic Preservation Act of 1966</i>
NPL	National Priorities List
OU	operable unit
PCB	polychlorinated biphenyl
RAWP	removal action work plan
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RL	U.S. Department of Energy, Richland Operations Office
RTD	remove, treat, and dispose
ROD	record of decision
S&M	surveillance and maintenance
SNF	spent nuclear fuel
Tri-Party Agreement	<i>Hanford Federal Facility Agreement and Consent Order</i>
TSD	treatment, storage, and disposal
WIDS	Waste Information Data System



## METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
<i>If You Know</i>	<i>Multiply By</i>	<i>To Get</i>	<i>If You Know</i>	<i>Multiply By</i>	<i>To Get</i>
<b>Length</b>			<b>Length</b>		
inches	25.4	millimeters	millimeters	0.039	Inches
inches	2.54	centimeters	centimeters	0.394	Inches
feet	0.305	meters	meters	3.281	Feet
yards	0.914	meters	meters	1.094	Yards
miles	1.609	kilometers	kilometers	0.621	Miles
<b>Area</b>			<b>Area</b>		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	Acres
<b>Mass (weight)</b>			<b>Mass (weight)</b>		
ounces	28.35	grams	grams	0.035	Ounces
pounds	0.454	kilograms	kilograms	2.205	Pounds
ton	0.907	metric ton	metric ton	1.102	Ton
<b>Volume</b>			<b>Volume</b>		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	Pints
fluid ounces	30	milliliters	liters	1.057	Quarts
cups	0.24	liters	liters	0.264	Gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
<b>Temperature</b>			<b>Temperature</b>		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
<b>Radioactivity</b>			<b>Radioactivity</b>		
picocuries	37	millibecquerel	millibecquerels	0.027	Picocuries





## 1.0 INTRODUCTION

### 1.1 PURPOSE AND SCOPE

This document presents the results of an engineering evaluation/cost analysis (EE/CA) that was conducted to evaluate alternatives and recommend an approach for disposition of 27 buildings (subsequently referred to as facilities<sup>1</sup>) located in the 100-K Area of the Hanford Site. The facilities are currently inactive, and the U.S. Department of Energy (DOE), Richland Operations Office (RL) has determined there is no further use for them. Hazardous substances<sup>2</sup> in these facilities present a potential threat to human health and the environment to the extent that action is warranted for the facilities. The lead regulatory agency, the U.S. Environmental Protection Agency (EPA), has determined that a non-time-critical removal action is appropriate to mitigate the potential hazards present in the 100-K Area ancillary facilities. An action memorandum, which will be developed from this EE/CA, will document and authorize implementation of the removal action that is selected for the facilities.

The 27 facilities within the scope of this evaluation are listed in Table 1-1. The scope includes above-ground structures (e.g., walls and roof) and their foundations to a depth of 1 m (3.3 ft) below grade. Deeper subsurface structures and closure of soils associated with the facilities are generally excluded from this evaluation and are assumed to be within the scope of the remedial action program for the 100-KR-1 and 100-KR-2 Operable Units (OUs). Flexibility is provided in subsequent sections of this document to address subsurface structures and/or contaminated soil on a case-by-case basis.

### 1.2 BACKGROUND

The Hanford Site is a 1,517-km<sup>2</sup> (586-mi<sup>2</sup>) federal facility located in southeastern Washington State, along the Columbia River (Figure 1-1), and operated by the DOE. From 1943 to 1990, the primary mission of the Hanford Site was the production of nuclear materials for national defense. The 100 Area is the site of nine now-retired nuclear reactors and associated support facilities that were constructed and operated to produce weapons-grade plutonium. Past operations, disposal practices, spills, and unplanned releases resulted in contamination of the facility structures, underlying soil, and underlying groundwater in the 100 Area. Consequently, in November 1989, the 100 Area was one of four areas of the Hanford Site that was placed on the EPA's National Priorities List (NPL) under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), as amended by the *Superfund Amendments and Reauthorization Act of 1986*.

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<sup>1</sup> The term "facility" is used generically to encompass all the structures, buildings, piping, ducting, etc., associated with the building.

<sup>2</sup> "Hazardous substances" means those substances defined by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, Section 101(14), and includes both radioactive and chemical substances.

## Introduction

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The 100-K Area is the portion of the 100 Area that contains the 105-K East (KE) and 105-K West (KW) Reactor buildings and supporting facilities (Figure 1-2). Figure 1-3 is a recent aerial photograph of the 100-K Area. The area is subdivided into three OUs to address cleanup of the soil and groundwater contamination that resulted from past operations. The 100-KR-1 and 100-KR-2 OUs encompass liquid waste disposal sites, burial grounds, and soil waste sites. The 100-KR-4 OU addresses groundwater contamination underlying the 100-K Area. Geographically, the facilities addressed in this EE/CA are co-located with the 100-KR-1 and 100-KR-2 OU waste sites. The scope and role of other CERCLA cleanup actions in the 100-K Area, and their relationship to this removal action, are summarized in the following subsections.

### 1.2.1 Waste Site and Soil Cleanup

Approximately 50 waste sites with a range of radioactive and nonradioactive contaminants have been identified in the 100-K Area as part of the 100-KR-1 and 100-KR-2 OUs. Remediation of these sites is being conducted under the following three CERCLA interim action records of decision (RODs):

- The *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units* (EPA 1997) addresses liquid effluent disposal sites, including those in the 100-K Area.
- The *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (commonly referred to as the Remaining Sites ROD) (EPA 1999) addresses remediation of additional liquid and miscellaneous waste disposal sites.
- The *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units Hanford Site (100 Area Burial Grounds), Hanford Site, Benton County, Washington* (commonly referred to as the 100 Area Burial Grounds ROD) (EPA 2000) addresses remediation of burial grounds.

In accordance with an assumed residential land-use scenario, the selected remedial action specified in these RODs includes removal of contaminated soil and debris, treatment (as necessary to meet disposal facility acceptance criteria), and disposal. This remedial action is commonly referred to as remove, treat, and dispose (RTD).

Remediation of waste sites in the 100-K Area is under way. The current planning baseline calls for completing remediation of all sites in the 100-K Area by 2012. The proximity of some waste sites to facilities in the scope of this EE/CA may require specific scheduling and coordination between the waste site and facility remediation programs. Facilities where integration with waste site remediation is an issue are noted in Section 2.0 (Table 2-2).

## Introduction

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In addition to addressing known waste sites, the Remaining Sites ROD (EPA 1999) provides guidelines by which newly discovered sites may be designated as RTD sites or categorized as candidates for no further action (candidate sites) pending evaluation. These guidelines will be pertinent to residual contamination (e.g., subsurface structures or soil) at the facilities addressed in this EE/CA.

### 1.2.2 Groundwater Cleanup

Chromium is the primary groundwater contaminant underlying the 100-K Area (100-KR-4 OU). Remediation of the chromium is being conducted under the *Interim Action Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units, Hanford Site, Benton County, Washington* (EPA 1996). As required by the 100-HR-3 and 100-KR-4 ROD, a full-scale pump-and-treat system was constructed in the 100-K Area with the objective of removing hexavalent chromium via ion-exchange technology. The treated groundwater is reinjected upgradient in the 100-K Area. The system has been operating since 1997. No specific impacts on 100-K Area facilities' remediation are anticipated, other than nominal coordination of field activities.

### 1.2.3 K Area Fuel Storage Basins Cleanout and K Reactors Interim Safe Storage

The 105-KE and 105-KW fuel storage basins (K Basins), located respectively inside of the 105-KE and 105-KW Reactor buildings, have been the storage locations for the majority of the Hanford Site's spent nuclear fuel (SNF) since the 1970s. In addition to SNF, the basins contain contaminated sludge, water, and debris. The basins are included in the 100-KR-2 OU. The K Basins cleanout is being conducted as an interim remedial action under CERCLA. The ROD authorizing the cleanout (EPA 1999) requires DOE to remove the SNF, sludge, water, and debris from the basins and then deactivate the basins. Removal of the SNF is in progress and is anticipated to be complete by 2004. Sludge, water, and debris removal, decontamination, and deactivation are anticipated to be complete by 2009. The K Basins themselves are not within the scope of this EE/CA.

One of the facilities that is currently active, the 1706-KE Building, contains four units (e.g., tanks and ion-exchange columns) that are regulated as treatment, storage, and disposal (TSD) units under the *Resource Conservation and Recovery Act of 1976* (RCRA). The TSD units will be remediated under the authority of the Remaining Sites ROD (EPA 1999).

Decontamination and decommissioning (D&D) and interim safe storage of the K Reactors will be evaluated in a separate EE/CA, which will be prepared following cleanout of the K Basins. Milestone M-93-23 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1998) requires submittal of the K Reactors EE/CA by July 31, 2006. This milestone may need to be renegotiated to align with the current K Basin cleanout schedule.

### 1.3 REMOVAL ACTION AUTHORITY

The *Policy on Decommissioning Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* (DOE and EPA 1995) is a joint policy between DOE and EPA that allows use of the CERCLA removal action<sup>1</sup> process (40 *Code of Federal Regulations* [CFR] 300.415) for deactivation and D&D activities. The facilities must contain hazardous substances to qualify for inclusion in the removal action process. The removal action process also requires preparation of an EE/CA to identify and evaluate alternatives for proposed removal actions.

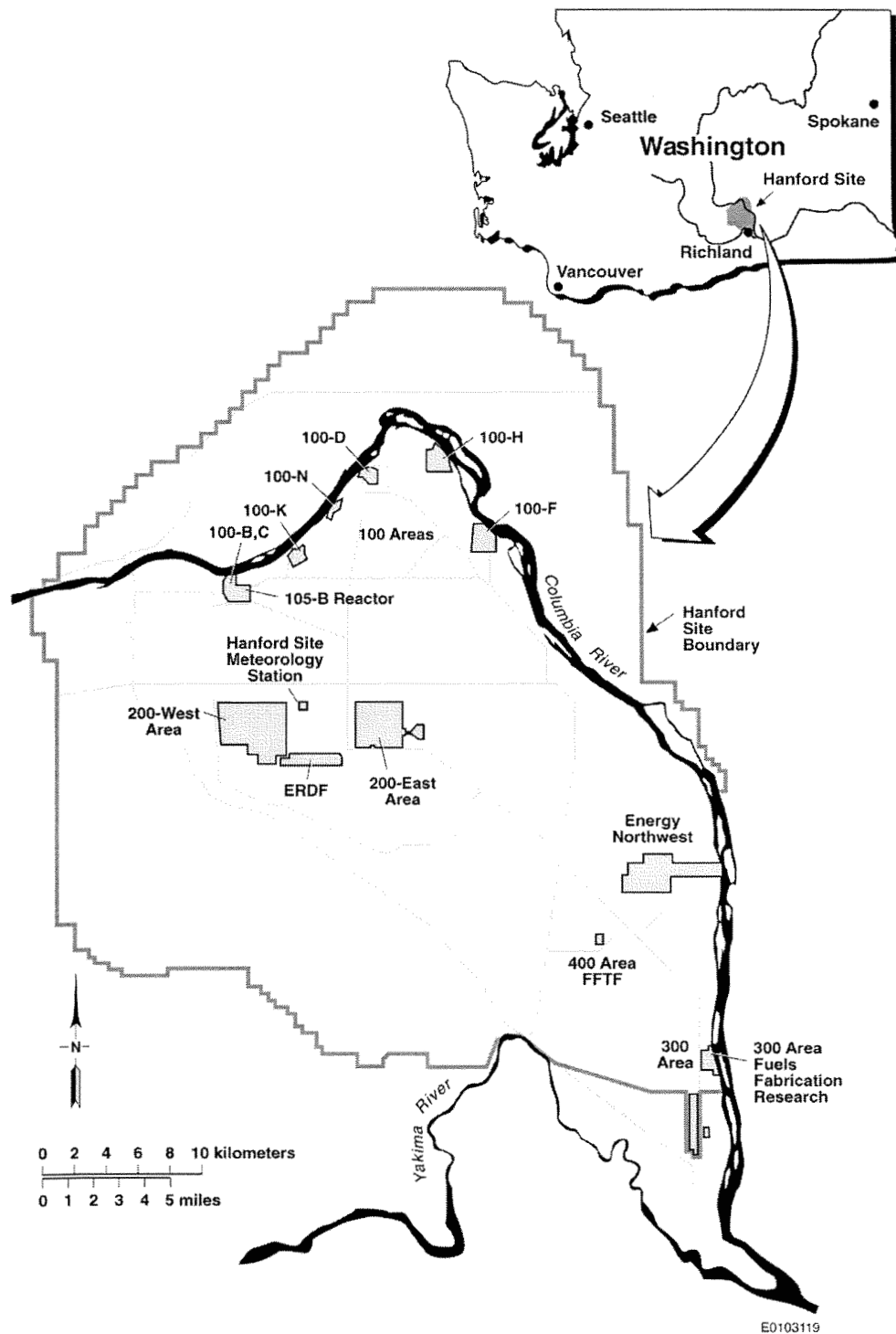
This EE/CA was prepared in accordance with CERCLA and 40 CFR 300.415 to satisfy environmental review requirements for non-time-critical removal actions and to provide a framework to evaluate and select alternative approaches for disposition of the identified 100-K Area facilities. This EE/CA also specifies actions designed to comply with requirements of the DOE and EPA joint policy (DOE and EPA 1995) and the Tri-Party Agreement (Ecology et al. 1998). The EPA, Washington State Department of Ecology (Ecology), and DOE (referred to as the Tri-Parties) have determined that the facilities included in the scope of this EE/CA qualify for the removal action process, based on the known presence of hazardous substances. After the public has had an opportunity to comment on the alternatives and the recommended approach presented in this document, the Tri-Parties will select the most appropriate removal action for the facilities. The DOE will prepare an action memorandum (a CERCLA decision document) to reflect the decisions made by the Tri-Parties.

In accordance with a Secretary of Energy policy statement (DOE 1994) and DOE O 451.1B, *National Environmental Policy Act of 1969* (NEPA) values have been incorporated into this EE/CA. The policy statement and DOE order encourage integration of NEPA values into CERCLA documents (such as this EE/CA) to the extent practicable, rather than requiring separate documentation. A discussion of NEPA values is included in Section 5.4 of this document.

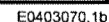
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<sup>1</sup> "Remove" or "removal," as defined by Section 101(23) of CERCLA, refers to the cleanup or removal of released hazardous substances from the environment; actions if a threat of hazardous substances release occurs; actions to monitor, assess, and evaluate the release (or threat of release) of hazardous substances; the disposal of removed material; or other actions that may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release. If a planning period of at least 6 months exists before onsite actions must be initiated, the removal action is considered non-time-critical, and an EE/CA is conducted.

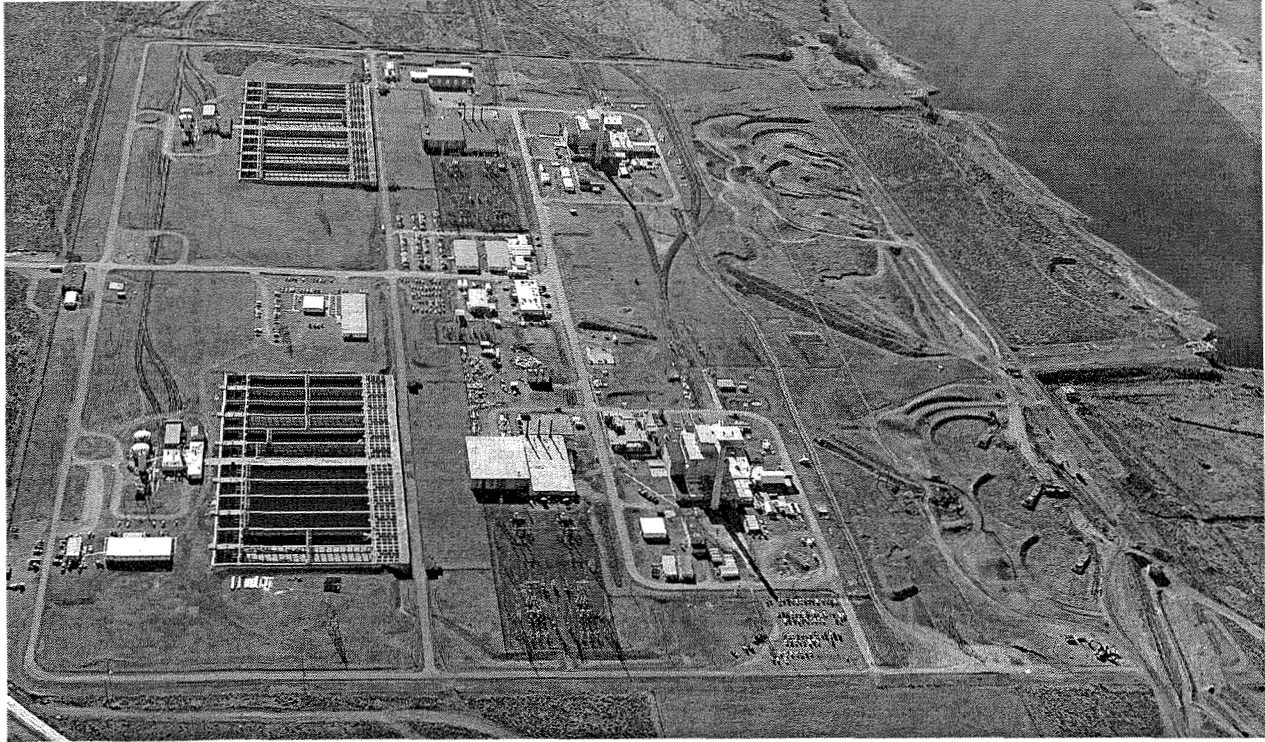
Figure 1-1. Hanford Site Map.



**Figure 1-2. Map of the 100-K Area.**



**Figure 1-3. Aerial Photograph of the 100-K Area.  
(The 100-KE facilities are in the foreground.)**





**Table 1-1. 100-K Area Facilities Included in the Scope of the Engineering Evaluation/Cost Analysis.**

Facility Number	Facility Name
110-KW	Gas Storage
115-KW	Gas Recirculation Building
116-KW	Reactor Exhaust Stack
117-KW	Exhaust Air Filter Building
118-KW-2	Horizontal Control Rod Storage Cave
119-KW	Exhaust Air Sampling Building
166-KW	Oil Storage Vault
183-KW	Chlorine Car Protection Building
183.1-KW	Head House
183.2-KW	Sedimentation Basins
183.3-KW	Filter Basin
183.4-KW	Reservoir and Clearwells
183.5-KW	Lime Feeder Building
183.6-KW	Lime Feeder Building
183.7-KW	Pipe Tunnel
190-KW	Process Water Pumphouse
110-KE	Gas Storage
115-KE	Gas Recirculation Building
116-KE	Reactor Exhaust Stack
117-KE	Exhaust Air Filter Building
118-KE-2	Horizontal Control Rod Storage Cave
166-KE	Oil Storage Vault
182-K	Emergency Water Pumphouse
1614-KE	Environmental Monitoring Station
1701-K	Patrol Headquarters (part of 1720-K)
1720-K	Office and Telephone Exchange
1909-K	Effluent Valve Pits

## 2.0 SITE CHARACTERIZATION

### 2.1 BACKGROUND AND SITE DESCRIPTION

Background information on the 100-K Area is provided in the following subsections, including operational history, land use and access, ecological setting, and cultural resources.

#### 2.1.1 General Description of the Hanford Site 100-K Area

The 100-K Area is located in the north-central portion of the Hanford Site, along the southern shoreline of the Columbia River. Construction of the KE and KW Reactor areas began in 1952 as part of the "Project X" expansion program. Project X was, in part, a response to the Korean conflict and tensions with the Chinese and Russians during the Cold War. The reactors and many of the associated supporting facilities were designed to withstand an enemy attack. This was accomplished in a variety of techniques that included the following:

- Construction of facilities below grade and/or as low as possible
- Physical separation of facilities
- Alternate sources of power
- Critical piping and wiring placed below grade
- Water and fuel storage placed below grade
- Facilities designed with frangible<sup>1</sup> walls and roofs.

Completion of the reactors was accomplished in 27 months from beginning to end. Startup of the reactors began in 1955. At that time, the reactor design was the largest constructed at the Hanford Site, beginning at 1,850 megawatts and gradually reaching 4,000 megawatts. Operations were discontinued in 1970 for the KW Reactor and in 1971 for the KE Reactor. Most of the buildings were deactivated with the shutdown of the reactors, with the exception of the fuel storage basins, the alum tanks adjacent to the 183.1-KE facility, research and development conducted in the 1706-KE Building, one pumphouse, one water treatment facility, and septic tanks and drain fields used for sanitary waste.

#### 2.1.2 Land Use and Access

Public access to the Hanford Site, including the 100-K Area, is currently restricted. Current land use in the 100-K Area consists of environmental cleanup activities and the removal of materials from the storage basins. Adjacent to and north of the 100-K Area, the Columbia River is accessible to the public for recreational use (e.g., boating and sport fishing). The river segment located north of the 100-K Area (referred to as the Hanford Reach) received National Monument status in 2000 (65 *Federal Register* [FR] 37253).

In prehistoric and early historic times, the area along the banks of the Columbia River, including the 100-K Area, was a focal point for camping and village sites for Mid-Columbia Plateau

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<sup>1</sup> "Frangible" refers to structures that are easily broken or breakable under external stress or forces.

Native American tribes. More recently, before government acquisition of the land in January 1943, the area was used for irrigated and dry-land farming and livestock grazing.

The DOE believes the reasonably anticipated future use of the 100-K Area is preservation/conservation. This land use is consistent with the “Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)” (64 FR 61615), which provides for four land-use designations in the Columbia River Corridor, encompassing the 100 Area. These land uses are preservation<sup>1</sup>, high-intensity recreation<sup>2</sup>, low-intensity recreation<sup>3</sup>, and conservation (mining)<sup>4</sup>. The river islands and a quarter-mile buffer zone along the river are designated as “preservation” to protect cultural and ecological resources. The river islands and buffer zone also constitute the Hanford Reach National Monument created by Presidential Proclamation 7319 (65 FR 37253), which states that the 100 Areas will not be developed for residential or commercial use in order to protect the area’s cultural and natural resources. The majority of the 100-K Area ancillary facilities are not within the quarter-mile buffer zone.

The high-intensity and low-intensity recreation designations are limited to specific sites and areas, none of which are in the 100-K Area. The remainder of land within the Columbia River Corridor outside the quarter-mile buffer zone is designated for “conservation (mining).” This designation will allow DOE to protect sensitive cultural and biological resource areas while allowing access to geologic resources in support of governmental missions or to further the biological function of wetlands (e.g., conversion of a gravel pit to a wetland by excavating to groundwater). Restrictions on certain uses may continue to be necessary to prevent the mobilization of contaminants, the most likely example of such restrictions involving activities that discharge water to the soil or excavate below a specified depth.

### 2.1.3 Flora and Fauna

The ecological setting within the 100-K Area perimeter fence is highly disturbed, with large graveled areas adjacent to the facilities. The area surrounding the 100-K Area is characterized as an arid to semi-arid shrub-steppe vegetation zone. The natural community is a sagebrush/bitterbrush/Sandberg’s bluegrass association. The dominant nonriparian vegetation in the surrounding area includes cheatgrass, Sandberg’s bluegrass, rabbitbrush, Russian thistle, and

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<sup>1</sup> An area managed for the preservation of archeological, cultural, ecological, and natural resources. No new consumptive uses (i.e., mining or extraction of nonrenewable resources) would be allowed within this area. Limited public access would be consistent with resource preservation.

<sup>2</sup> An area allocated for high-intensity, visitor-serving activities and facilities (commercial and governmental) such as golf courses, recreational vehicle parks, boat-launching facilities, Tribal fishing facilities, destination resorts, cultural centers, and museums.

<sup>3</sup> An area allocated for low-intensity, visitor-serving activities and facilities, such as improved recreational trails, primitive boat-launching facilities, and permitted campgrounds.

<sup>4</sup> An area reserved for the management of protection of archeological, cultural, ecological, and natural resources. Limited and managed mining (e.g., quarrying for sand, gravel, basalt, and topsoil for governmental purposes) could occur as a special use (i.e., a permit would be required) within appropriate areas. Limited public access would be consistent with resource conservation.

tumblemustard. The animal community in the surrounding area includes several species of birds, mammals, reptiles, and insect groups that are adapted to the semi-arid environment.

Within the 100-K Area, most of the complex has been characterized as highly disturbed by industrial/waste management operations to the extent that plant communities are sparse, and complete ecological communities represented by common food webs cannot be supported. No plants or animals on federal or state lists of endangered or threatened plants/wildlife are found in the 100-K Area. There are no perennial or ephemeral streams or regulated wetlands within the complex. This characterization is representative of the geographical area defined by the facilities addressed in this EE/CA.

Before initiating a project on the Hanford Site, ecological reviews are conducted to ensure that sensitive plant or animal species will not be impacted. Because the 100-K Area is highly disturbed, the only significant ecological issue is nesting birds protected by the *Migratory Bird Treaty Act of 1918*. At the few locations with nesting migratory birds, the nests cannot be disturbed until the young have fledged. Annual baseline reviews include surveys for nesting birds and a reconnaissance to determine if any sensitive plants are growing in the 100-K Area. Following the annual review, the project will be notified of any active nests or sensitive issues, and appropriate actions will be taken.

#### **2.1.4 Cultural Resources**

The 100-K Area bounds a culturally sensitive area, having been occupied prehistorically and historically by Native Americans. Building construction and general industrial activities have disturbed much of the 100-K Area, including the geographical area addressed in this EE/CA. However, undisturbed deposits containing vestiges of villages and perhaps human remains may exist.

Prior to initiating a project on the Hanford Site, a cultural resource review is required to ensure that impacts to cultural resources will not occur. A cultural resources review will be performed in compliance with the requirements of the *National Historic Preservation Act of 1996* (NHPA) and the *Programmatic Agreement Among the U.S. Department of Energy Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington* (programmatic agreement) (DOE-RL 1996) to address the 100-K Area facilities.

Thirty-eight Cold War era buildings and structures have been inventoried in the 100-K Area. Fifteen of these (105-KW, 105-KW Rod Tip Cave, 107-KW, 116-KW, 117-KW, 119-KW, 181-KW, 183-KW, 190-KW, 1701-K, 1706-KE, 1706-KER, 1717-K, 1720-K, and 1908-KE) were determined to be contributing properties within the Hanford Site Manhattan Project and Cold War Era Historic District and, therefore, are eligible for listing in the National Register of Historic Places (NPS 1988). Five of these facilities are included in the scope of this EE/CA and are identified in Table 2-1.

As required by Stipulation II(A) of the programmatic agreement (DOE-RL 1996), the operational history and/or significant engineering achievements of these eligible properties was documented on either Expanded Historic Property Inventory Forms or standard Historic Property Inventory Forms. The contribution these structures made to the Cold War is described in *The Hanford Site Historic District* (DOE-RL 2002), which is consistent with the programmatic agreement, Stipulation VI.

Physical effects to these eligible properties, up to and including demolition, have been mitigated. In compliance with the programmatic agreement (Stipulation V[C]), the contents of these eligible properties were also evaluated to identify artifacts that may have interpretive or educational value as exhibits within local, state, or national museums. Thirty-three artifacts were located and marked for retention within 105-KE (22 items), 105-KW (9 items), and 190-KW (2 items). However, in order to complete the mitigation requirements under the programmatic agreement (DOE-RL 1996), these artifacts will need to be retrieved and transported to an appropriate curation facility before any demolition activities occur.

## 2.2 FACILITY AND WASTE SITE DESCRIPTIONS

The 27 facilities addressed in this EE/CA include a combination of support facilities, storage buildings, shops, and offices located in the 100-K Area (Figure 1-2). This section provides a brief description of each facility. In addition, any 100-KR-1 or 100-KR-2 OU waste sites that IS present beneath and/or adjacent to the facilities included in this EE/CA IS identified in Table 2-2. Detailed summaries of each facility, including the operational history, process history, and characterization, are presented in Appendix A.

**110-KW Gas Storage.** The 110-KW Gas Storage facility is an outdoor unloading gas storage area that supported the 115-KW Building. The facility contained high-pressure helium tanks and four large-diameter tanks used for carbon dioxide. A railroad spur and associated equipment for transferring gas at high pressure were used at the site. The high-pressure tanks have been removed; however, the concrete supports remain.

**115-KW Gas Recirculation Building.** The 115-KW Gas Recirculation Building is a single-story facility that was designed to house gas circulation pumps, gas dryers, filters, heat exchangers, and related instruments and piping for the reactor gas coolant system. It was also designed to detect water leaks within the reactor cores. The facility contains heaters/coolers, gas dryer towers, condensers, filters, pumps, silica-gel drying beds, piping and ductwork, heating and ventilation systems, spindle-type helium storage tanks, and a gas unloading room.

**116-KW Reactor Stack (132-KW-1).** The 116-KW Reactor Stack was originally 91 m (300 ft) high and designed to discharge ventilation exhausts into the atmosphere from the KW Reactor. The stack was constructed to prevent the possible buildup of radioactivity near the plant areas. In 1960, following the completion of the confinement project, air was diverted through underground concrete ducts to the 117-KW Filter Building. Air was discharged out the exhaust

stack after flowing through the filters. In 1980 and 1981, the stack was shortened to 53 m (175 ft). The rubble was placed inside the remaining portion of the stack.

The 116-KW Reactor Stack is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.

**117-KW Exhaust Air Filter Building (100-K-61).** The 117-KW Exhaust Air Filter Building was constructed as part of the reactor confinement project. The 117-KW facility was designed to filter ventilation air from the confinement zone of the KW Reactor building before its discharge into the atmosphere through the 116-KW Reactor Stack. The building was constructed almost entirely below grade and houses two identical filter cells with an operating gallery. The roof was constructed with a steel frame with large steel hatch covers. The facility is divided into two large filter cells that are separated by a small operating area. The filters were particulate and activated charcoal. Underground concrete ventilation and gas pipe tunnels extend from the reactor to the 115-KW and 117-KW Buildings and to the reactor stack. The tunnels serve as intake and exhaust plenums to the filter cells.

The 117-KW Exhaust Air Filter Building is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.

**118-KW-2 Horizontal Control Rod Storage Cave.** The 118-KW-2 Horizontal Control Rod Storage Cave was constructed on a concrete slab, with 60-cm (24-in.)-diameter pipe cut in half and laid lengthwise (open side down) on the slab that formed a 12-m (40-ft)-long tunnel. Each end of the tunnel contains a vertical concrete wall and steel doors. The storage cave was used for temporary storage of irradiated and radioactively contaminated horizontal control rods. The control rods were placed within the tunnel during temporary storage. The tunnel is covered with 1.8 m (6 ft) of fill material.

**119-KW Exhaust Air Sampling Building.** The 119-KW Exhaust Air Sampling Building is a small, pre-engineered, ribbed-metal building on a concrete slab foundation located over the ventilation ducts that lead to the 117-KW Building. The building housed most of the instrumentation for the exhaust air systems.

The 119-KW Exhaust Air Sampling Building is eligible for inclusion in the National Register of Historic Places as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.

**166-KW Oil Storage Vault (132-KW-2).** The 166-KW Oil Storage Vault (oil storage building) was designed to provide storage for the fuel oil used in the 100-K Area. One underground oil storage tank is located west of the control building. The tanks contain two compartments with a combined capacity of 6,435,200 L (1,700,000 gal), two 170,343-L (45,000-gal)-capacity day tanks, and a pump room. At ground level is a concrete penthouse. Bunker No. 6 fuel oil was

stored in the tanks. The Waste Information Data System (WIDS) states that approximately 7,570 L (2,000 gal) of oil remains in the tanks.

**183-KW Chlorine Car Protection Building.** The chlorine car protection building contained two bays, with a railroad spur at each bay. The doors of the building are blast resistant. Chlorine was stored and used directly from railroad tank cars, and air pressure was used for unloading. Chlorine was fed from the railcars to evaporators, which vaporized the chlorine into a gaseous state. From the evaporators, the chlorine passed to a visible vacuum-type chlorinator that controlled the injection rate in proportion to raw water flow. The injection of chlorine is blended with raw water to form a chlorine solution. Three evaporators and three chlorinators were used, two for active use and one for standby.

**183.1-KW Headhouse.** The headhouse is the water quality center for the water treatment plant. The headhouse controlled the operations of the chlorination of raw water, addition of coagulants to raw water, pH correction of filtered water, addition of corrosion inhibitor to process water, and influent and effluent control. The headhouse contained equipment for metering raw water; for chemical injection into raw, filtered, and process water; and for effluent and influent control for the filter plant.

The headhouse is a single-story, T-shaped structure. The main wing contained the control equipment and personnel facilities, electrical equipment room, main control room, laboratory, lunchroom, locker and restroom, and chlorine equipment room. The remaining portion of the facility housed the sanitary water filters, filter control board, water softeners, caustic soda and alum feeding pumps, activated silica batching and storage tanks, and silica batch control board. The basement of the main wing contained the raw water manifolds, metering stations, and the alum and activated silica injection points. The stem section of the basement contained the chemical heat exchangers, water glycol heat exchangers, circulating pumps, silica batching and storage tanks, and air compressors.

The 183.1-KW Headhouse is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.

**183.2-KW Flocculation and Sedimentation Basins.** The 183.2-KW Flocculation and Sedimentation Basins were designed to provide thorough mixing of chemicals when added to the water in the 183.1-KW Headhouse. The mixing prevented coagulation of suspended matter particles and settlement of suspended solids. The facility is capable of handling a maximum total water flow of 592,800 L/min (156,000 gal/min). The flocculation basins fed water directly into the sedimentation basins.

The sedimentation basins contained six individual sections, three on each side of a central tunnel, interconnected through two distribution flumes. Water from the sedimentation basins entered the filter basin.

**183.3-KW Filter Basin.** The 183.3-KW Filter Basin was designed to remove unsettled floc and other small, suspended particles carried by the water from the sedimentation basins. The filter building contains three sections: flumes, filters, and pipe gallery. The flumes are a vertical bank of concrete conduits located adjacent to, and paralleling, the entire width of the basins. The filters are immediately beyond the flumes and contain two beds and a central gullet separating the beds. Water flowed from the flumes through filter sluice gates into each filter gullet. A pipe gallery runs the entire length of the filter, which included the central tunnel. Filtered water flowed from the filters, through the filter effluent flumes toward the outer ends of the flumes, and delivered to the clearwells.

**183.4-KW Reservoir and Clearwells.** The 183.4-KW Clearwells were designed to provide underground storage of filtered water. The clearwells are constructed of reinforced concrete. The two clearwells are each capable of holding 34,068,708 L (9,000,000 gal) of water. A pipe tunnel divides the two reservoirs on the centerline. A gravity pipe connection is located between the bottoms of the two halves of the reservoirs. The pipe is located under the tunnel, with an overflow line from each reservoir connected to the main sewer.

**183.5-KW Lime Feeder Building.** The 183.5-KW Lime Feeder Building was designed to discharge lime through a pair of flash mixers to the clearwells. Lime was added to the water to obtain the proper pH. The lime building contained an automatic, dry, gravimetric belt-type feeder with a capacity of 226.7 kg/hr (500 lb/hr); a hopper; a weir box; and a lime feeder. Lime was delivered by railcar and stored in steel silos.

**183.6-KW Lime Feeder Building.** The 183.6-KW Lime Feeder Building is identical in design and function to the 183.5-KW Lime Feeder Building. The 183.6-KW Lime Feeder Building is located on the east side of the 183.4-KW Reservoir and Clearwells.

**183.7-KW Pipe Tunnel.** The 183.7-KW Pipe Tunnel extended from the 183.1-KW Headhouse through the center of the water treatment plant to the 190-KW Process Water Pumphouse. The tunnel contains two 152-cm (60-in.) raw water lines, a 76-cm (30-in.) sewer line, and an elevated walkway.

**190-KW Process Water Pumphouse.** The 190-KW Process Water Pumphouse is a single-story building designed to house all large water pumping units, which included service and backwash pumps. The pumphouse developed the pressure necessary to pump treated water to the reactor for cooling. The facility contained six dual-pumping sets of process pumps designed to provide a positive suction head to the secondary pump, and also to furnish water during transient shutdown. In addition, it contained primary and secondary pumps.

The 190-KW Process Water Pumphouse is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.

**110-KE Gas Storage.** The 110-KE Gas Storage facility is an outdoor unloading and gas storage area that supported the 115-KE Building. The facility contained high-pressure helium tanks and



four large-diameter tanks used for carbon dioxide. The facility contained a railroad spur, with associated equipment for transferring gas at high pressure.

**115-KE Gas Recirculation Building.** The 115-KE Gas Recirculation Building is a single-story facility that was designed to house gas circulation pumps, gas dryers, filters, heat exchangers, and related instruments and piping for the reactor gas coolant system. It was also designed to detect water leaks within the reactor cores. The facility contains gas dryer towers, heaters/coolers, condensers, filters, pumps, silica-gel drying beds, piping and ductwork, heating and ventilation systems, spindle-type helium storage tanks, and a gas unloading room.

**116-KE Reactor Stack (132-KE-1).** The 116-KE Reactor Stack was designed to discharge ventilation exhausts into the atmosphere from the KE Reactor to prevent the possible buildup of radioactivity near the plant areas. The original construction was 91 m (300 ft) high. In 1960, following completion of the confinement project, air was diverted through underground concrete ducts to the 117-KE Filter Building. After the air flowed through the filters it was discharged out the exhaust stack. In 1980 and 1981, the stack was shortened to 53 m (175 ft). The rubble was placed inside the remaining portion of the stack.

**117-KE Exhaust Air Filter Building (100-K-62).** The 117-KE Exhaust Air Filter Building was constructed as part of the reactor confinement project. The system modification filtered ventilation air from the confinement zone of the KE Reactor building through the 117-KE facility before its discharge into the atmosphere through the 116-KE Reactor Stack. The facility was constructed almost entirely below grade. The roof was constructed with a steel frame with large hatch doors. The filters were constructed of particulate and activated charcoal. Underground concrete ventilation and gas pipe tunnels extend from the reactor to the 115-KE and 117-KE Buildings and to the reactor stack. The tunnels serve as intake and exhaust plenums to the filter cells.

**118-KE-2 Horizontal Control Rod Storage Cave.** The 118-KE-2 Horizontal Control Rod Storage Cave was constructed on a concrete slab, with 60-cm (24-in.)-diameter pipe cut in half and laid lengthwise (open side down) on the slab that formed a 12-m (40-ft)-long tunnel. Each end of the tunnel contains a vertical concrete wall and steel doors. The storage cave was used for temporary storage of irradiated and radioactively contaminated horizontal control rods. The control rods were placed within the tunnel during temporary storage. The tunnel is covered with 1.8 m (6 ft) of fill material.

**166-KE Oil Storage Vault (130-KE-2).** The 166-KE Oil Storage Vault (oil storage building) was designed to provide storage for the 165-KE boiler's fuel oil. The facility contained one underground oil storage tank located west of the control building, two 170,343-L (45,000-gal)-capacity day tanks, and a pump room. Bunker No. 6 fuel oil was stored in the tanks. From 1981 to 1985, the facility was used for the storage of Bunker C oil for the 100-N Area. The WIDS database reports that approximately 7,570 L (2,000 gal) of oil remains in the concrete tank.

**1614-KE Environmental Monitoring Station.** The 1614-KE Environmental Monitoring Station is centrally located between the KE and KW Reactors. The facility was constructed of

concrete block on a concrete slab, and measures about 2.4 by 2.4 m (8 by 8 ft). The roof was constructed of tongue-and-groove sheathing with an asphalt and gravel covering. Historical documentation was not located for this facility.

**182-K Emergency Water Pumphouse.** The 182-K Emergency Water Pumphouse housed diesel engine-driven pumping gear and related equipment for emergency reactor cooling. The facility was designed to pump water from either the KE or KW clearwells to either the KE or KW Reactors for emergency cooling. Two 66,619-L (17,599-gal) underground steel diesel oil storage tanks were located on the north side of the facility. The tanks were removed in 1993.

**1701-K Patrol Headquarters.** The 1701-K Patrol Headquarters (badgehouse and radio patrol building) is a single-story facility attached to the 1720-K Building, located at the main entrance to the 100-K Area.

**1720-K Office and Telephone Exchange.** The 1720-K Office and Telephone Exchange (patrol headquarters and administrative office) is a single-story building designed to provide facilities for security patrol, duplicating, and mail operations. A portion of the building was used for the telephone exchange and patrol radio rooms, with the remainder of the building containing offices, an ordinance room, an assembly room, a locker room, and other personnel facilities. The 1720-K Building adjoins the 1701-K Building, sharing a common wall. Portions of the building were later used by General Telephone Electric for the telephone exchange.

**1909-K Effluent Valve Pits.** The 1909-K Effluent Valve Pit is located near the west wall of the KE Reactor, north of the rod rack and near the east wall of the KW Reactor. A 91-cm (36-in.) and a 182-cm (72-in.)-diameter pipe each enters the north side of the junction box. Pipelines enter the reactor buildings from the junction box. The 182-cm (72-in.) pipe rests in concrete saddles that sit on a concrete slab. A 30-cm (12-in.), Schedule 40 stainless-steel bypass line is present near the bend in the pipe.

**100-KR-1 and 100-KR-2 OU Waste Sites.** As discussed previously, the geographical area defined by the facilities addressed in the scope of this EE/CA may include underlying and adjacent waste sites, which are summarized in Table 2-2. As indicated in Table 2-2, some of the waste sites consist of the actual facility rather than underlying soil. Consequently, these facilities must be demolished and removed in their entirety to address the waste sites as part of the removal action. Additional information on the waste sites associated with the geographical area defined by the facilities included in this EE/CA is provided in Appendix A and in the WIDS database.

## 2.3 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

The source of contamination at each facility within the 100-K Area ancillary facilities depended on the specific operations conducted at the facility. In general, contamination at the facilities addressed in this EE/CA resulted from activities associated with the operation of two single-pass, water-cooled reactors used to produce weapons-grade plutonium. The 100-K Area ancillary

facilities provided treated water, backup power and steam, material storage and distribution, and maintenance support during construction, operation, and deactivation of the reactors.

Radiological and hazardous material contamination may be associated with these facilities.

To the extent practicable, hazardous substances (including bulk chemicals that are no longer in use) have been, or will be, removed from the facilities during routine operations and surveillance and maintenance (S&M). However, at many of the facilities, residual contamination remains or will remain on facility surfaces (including the roof), in piping and ductwork, and in structural materials. In general, the primary contaminants of concern include the following radionuclides:

- Americium-241
- Cesium-137
- Cobalt-60
- Strontium-90
- Tritium
- Plutonium.

At most of the facilities, the activities of individual isotopes are not currently known but will be determined, as needed, through data quality objective (DQO)-directed sampling and analysis tasks before disposal.

The facilities also contain nonradioactive hazardous substances as either contaminants from operations or components of structural materials. These may include the following:

- Friable and nonfriable forms of asbestos
- Lead paint
- Lead shielding
- Polychlorinated biphenyls (PCBs)
- Mercury (in switches, gauges, and thermometers)
- Refrigerants (freon)
- Petroleum products
- Water treatment products
- Lubricants
- Corrosives
- High-efficiency particulate air filter media
- Sodium-vapor and mercury-vapor lighting.

The concentrations of contaminants will be determined, as needed, through DQO-directed sampling and analysis tasks before disposal.

## 2.4 RISK EVALUATION AND SITE CONDITIONS THAT JUSTIFY A REMOVAL ACTION

The ancillary facilities addressed in this EE/CA are known to be contaminated with radioactive and/or nonradioactive hazardous substances. The risks associated with the radioactive and nonradioactive contaminants have not been quantified. The following discussion provides a qualitative discussion of the risks.

The major contaminants of concern at the facilities addressed in this EE/CA are radionuclides, which are known carcinogens. Many of the facilities may contain low levels of radiological contamination as surface contamination or as a part of the structural material. Hazardous substances, including asbestos insulation, heavy metals (such as mercury in switches and lead shielding), and PCBs in building materials, are also present in the facilities.

A security fence currently surrounds the area to limit unauthorized entrance. In addition, the facilities are locked and require entry approval from the Facilities Decommissioning Project. As long as the DOE retains control of the 100-K Area, these institutional controls may prevent direct contact with, and exposure to, the hazardous materials. However, institutional controls will not prevent deterioration of the facilities and potential release of contaminants to the environment. Contaminants could be released directly to the environment through a breach in a pipe, containment wall, roof, or other physical control as the facilities age and deteriorate. Contaminants could also be released to the environment indirectly through animal intrusion into the contaminated structures and systems. Historically, intrusion and spread of contamination by rodents, insects, birds, and other organisms has been difficult to control and prevent.

Potential release of contaminants is currently mitigated through an ongoing S&M program. However, as the facilities continue to age and deteriorate, the threat of potential release of radioactive and hazardous substances increases, and it becomes more difficult to confine these materials from the environment. The S&M activities required to confine the hazardous substances may increase the risk of potential exposure to personnel. The potential exposure to workers and wildlife, the threat of future releases, and the risks associated with contamination at the facilities addressed in this EE/CA justify a non-time-critical removal action.

**Table 2-1. Facilities in 100-K Ancillary Facilities Engineering Evaluation/  
Cost Analysis Scope and Historical Significance.**

Facility	Description	Historical Significance
110-KW	Gas Storage	
115-KW	Gas Recirculation Building	
116-KW	Reactor Stack	X
117-KW	Exhaust Air Filter Building	X
118-KW-2	Horizontal Control Rod Storage Cave	
119-KW	Exhaust Air Sampling Building	X
166-KW	Oil Storage Vault	
183-KW	Chlorine Car Protection Building	
183.1-KW	Headhouse	X
183.2-KW	Sedimentation Basins	
183.3-KW	Filter Basin	
183.4-KW	Reservoir and Clearwells	
183.5-KW	Lime Feeder Building	
183.6-KW	Lime Feeder Building	
183.7-KW	Pipe Tunnel	
190-KW	Process Water Pumphouse	X
110-KE	Gas Storage	
115-KE	Gas Recirculation Building	
116-KE	Reactor Stack	
117-KE	Exhaust Air Filter Building	
118-KE-2	Horizontal Control Rod Storage Cave	
166-KE	Oil Storage Vault	
182-K	Emergency Water Pumphouse	
1701-K	Patrol Headquarters	
1720-K	Office and Telephone Exchange	
1909-K	Effluent Valve Pits	

<sup>a</sup> An "X" indicates that the associated facility qualifies for consideration as a historically significant property under the *National Historic Preservation Act of 1966*.

**Table 2-2. Facilities and Potentially Impacted 100-KR-1/100-KR-2 Operable Unit Waste Sites Included in the Scope of the Engineering Evaluation/Cost Analysis. (2 Pages)**

Facility Number	Facility Name	Potentially Impacted WIDS Sites
110-KW	Gas Storage	
115-KW	Gas Recirculation Building	116-KW-1 (Condensate Crib)
116-KW	Reactor Stack	
117-KW	Exhaust Air Filter Building	116-KW-1 (Condensate Crib); 132-KW-1 (Reactor Exhaust Stack)
118-KW-2	Horizontal Control Rod Storage Cave	100-K-11 (French Drain); 100-K-12 (French Drain)
119-KW	Exhaust Air Sampling Building	100-K-1 (Exhaust Air Sampling Building French Drain)
166-KW	Oil Storage Vault	130-KW-2 (Oil Storage Tank); 100-K13 (French Drain)
183-KW	Chlorine Car Protection Building	
183.1-KW	Headhouse	120-KW-3 (Sulfuric Acid Storage Tank); 120-KW-4 (Sulfuric Acid Storage Tank); 120-KW-5 (Sodium Dichromate Storage Tank); 120-KW-7 (Brine Pit and Pump Pit); 100-K-15 (West Liquid Alum Storage Tank); 100-K-16 (East Liquid Alum Storage Tank); 100-K-18 (Caustic Neutralization Pit); 100-K-19 (Caustic Soda Storage Tank); 100-K-20 (West Sodium Silicate Storage Tank); 100-K-21 (East Sodium Silicate Storage Tank); 100-K-24 (Bauxite Tank); 100-K-34 (Acid Neutralization Pit)
183.2-KW	Sedimentation Basins	
183.3-KW	Filter Basin	
183.4-KW	Reservoir and Clearwells	
183.5-KW	Lime Feeder Building	
183.6-KW	Lime Feeder Building	
183.7-KW	Pipe Tunnel	
190-KW	Process Water Pumphouse	
110-KE	Gas Storage	
115-KE	Gas Recirculation Building	116-KE-1 (Condensate Crib)
116-KE	Reactor Stack	
117-KE	Exhaust Air Filter Building	116-KE-1 (Condensate Crib); 132-KE-1 (Reactor Exhaust Stack)
118-KE-2	Horizontal Control Rod Storage Cave	100-K-9 (French Drain); 100-K-10 (French Drain)
166-KE	Oil Storage Vault	130-KE-2 (Oil Storage Tank)

**Table 2-2. Facilities and Potentially Impacted 100-KR-1/100-KR-2 Operable Unit Waste Sites Included in the Scope of the Engineering Evaluation/Cost Analysis. (2 Pages)**

Facility Number	Facility Name	Potentially Impacted WIDS Sites
1614-KE	Environmental Monitoring Station	
182-K	Emergency Water Pumphouse	130-K-3 (Emergency Diesel Oil Storage Tank)
1701-K	Patrol Headquarters	
1720-K	Office and Telephone Exchange	
1909-K	Effluent Valve Pits	

### 3.0 REMOVAL ACTION OBJECTIVES

The facilities addressed in this EE/CA pose a threat to human health and the environment. In most cases, the facilities contain radioactive and nonradioactive hazardous substances, either as surface contamination or as structural components. The contaminants and risks posed by the facilities were described in Sections 2.3 and 2.4.

In general, the scope of this removal action addresses only the facilities themselves. The soil underlying some of the facilities may also be contaminated. Where there is previous knowledge of such contamination, the soil has already been identified as a separate waste site and will be remediated under the authority of other CERCLA response actions. If extensive contamination associated with the underlying soil is identified in the future, it will be noted within the WIDS database and addressed under the 100-KR-1/100-KR-2 OU remediation process or other soil remediation activity.

Based on the potential hazards identified in Sections 2.3 and 2.4, the following removal action objectives have been identified:

- Protect human receptors from exposure to contaminants above acceptable exposure levels in facility structures
- Control the migration of contaminants from the facilities into the environment
- Facilitate and, to the extent practicable, be consistent with anticipated remedial actions within the 100-K Area OUs
- Prevent adverse impacts to cultural resources and threatened or endangered species
- Achieve applicable or relevant and appropriate requirements (ARARs) to the fullest extent practicable
- Safely treat, as appropriate, and dispose of waste streams generated by the removal action.





## **4.0 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES**

The removal action alternatives for the 27 facilities included in the scope of this EE/CA must be protective of human health and the environment and must not inhibit future implementation of remedial action operations for 100-KR-1/100-KR-2 OU waste sites located in the same geographical area. As presented in Section 2.0, the primary threats to be addressed in the selection of a removal action alternative are radioactive and/or nonradioactive hazardous substances contained in or around the facilities, and their contaminated surfaces, and the poor physical condition of selected facilities.

Based on the above considerations, the following three removal action alternatives were identified for the facilities:

- Alternative one: No action
- Alternative two: Deactivation/D&D
- Alternative three: S&M (with eventual deactivation/D&D).

### **4.1 ALTERNATIVE ONE – NO ACTION**

Evaluation of a no action alternative is required to provide a baseline for comparison with other active alternatives. Under the no action alternative, facility deactivation/D&D activities would not be performed, and current S&M activities would be discontinued. Hanford Site institutional controls (e.g., fencing and posted signs) would be maintained to help warn of hazards and to control worker and public access to the facilities. No other specific controls would be established for the facilities covered by this EE/CA. Because the facilities would not be decontaminated and no action would be taken to stop the facilities from deteriorating, there would be an increased threat and likelihood for a release of hazardous substances, potentially exposing workers, the public, or the environment. In addition, the no action alternative would impede remedial action progress for the 100-KR-1/100-KR-2 OU waste sites located in the geographical area. There is no cost associated with the no action alternative.

### **4.2 ALTERNATIVE TWO – DEACTIVATION/D&D**

Alternative two would consist of deactivation/D&D of the 27 facilities and associated waste disposal to mitigate hazards presented by the facilities and to prepare the area for remedial action. The deactivation/D&D alternative would be implemented as described in the following subsections.

#### **4.2.1 Deactivation**

The purpose of deactivation is to identify and remove barriers (e.g., physical, chemical, and radiological) to demolition of each facility. Before beginning deactivation, ongoing missions/programs must be shut down, and personnel and equipment/property must be relocated.

## Identification of Removal Action Alternatives

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Typically, space deactivation would be performed first, including removal of small miscellaneous items (e.g., PCB ballasts, batteries, lead, and mercury switches). Following the removal of small items, any remaining process and utility systems would be removed and drains would be plugged. Piping systems would be drained and residual materials would be removed from tanks, lubricant reservoirs, and refrigerant systems.

After the residual solid and liquid bulk hazards have been removed, the area, equipment, systems, and components would be decontaminated (when practical) or stabilized. Decontamination would be performed, to the extent feasible, to satisfy one or more of the following objectives:

- Minimize worker exposure to contaminants during demolition
- Reduce contaminated waste volumes
- Ensure that fugitive emissions do not exceed applicable air standards during demolition
- Reduce costs associated with worker protection and waste disposal.

Loose, accessible radiological contamination would be removed from components, equipment, structures, etc. as required to meet the waste acceptance criteria for the selected disposal facility. When practical, decontamination activities would be performed within proximity of the remediation work area using standard industry and best management practices, including minimizing the amount of water or cleaning fluids used.

When physical removal is not feasible or cost effective, contamination would be stabilized or “fixed” so that contaminants would remain attached to the materials and would be less likely to be disturbed during subsequent demolition activities. Common methods of fixing contamination include painting, applying asphalt, or spreading plastic sheeting. When deactivation is complete, all hazardous and radiological components would be removed or fixed in place to allow safe and cost-effective demolition of the facility.

### 4.2.2 Decontamination and Decommissioning

Immediately following deactivation, the D&D portion of this alternative would consist of radiological surveys, asbestos removal, and facility demolition/removal. Waste management/disposal would be performed as described in Section 4.4.2. Initially, radiological surveys would be performed. After the radiological conditions are established, biological cleanup and general housekeeping would be completed (e.g., remove loose biological feces and rubble, sweep and vacuum floors). Asbestos-containing material would be removed in accordance with existing procedures and an approved asbestos abatement work plan.

All above-grade structures would be removed or demolished to grade level. Demolition generally means large-scale facility destruction using heavy equipment (e.g., wrecking ball, excavator with a hoe-ram, shears, and concrete pulverizer), explosives, or other industrial methods. There are no unique features of the facilities that would suggest a need for use of innovative demolition methods. Consequently, no alternatives to the use of standard demolition techniques are identified. To the extent possible, steel would be segregated for salvage, unless it

is contaminated or removal is not economically feasible. Piping, duct conduit, and small equipment (e.g., pumps, motors, and vacuum units) may be dismantled and recycled, or loaded into waste containers for transport and disposal at the Environmental Restoration Disposal Facility (ERDF) or another approved waste facility in accordance with Section 4.1.

In general, below-ground structures (e.g., slab, basement, and foundation) would be demolished and removed to 1 m (3.3 ft) below grade or below the engineered structure. If the remaining area meets the final cleanup requirements of the applicable ROD (see Section 1.2.1), it will undergo cleanup/verification and documentation per the remedial action requirement. If the soils do not meet the cleanup/verification requirements of the applicable ROD, the site will be stabilized and deferred to the remedial action program. When feasible, remedial action will commence after completion of D&D. Where the facilities are located above or adjacent to known or suspected 100-KR-1/100-KR-2 OU waste sites and remedial action will not immediately follow D&D, the facility slab or foundation may be left in place at grade to accomplish one or more of the following objectives:

- Limit infiltration into an underlying waste site during the period between demolition and remedial action
- Minimize/reduce potential exposure to contaminants from an underlying waste site
- Avoid double handling and potential cross-contamination of clean backfill material that would be excavated as part of the remedial action.

Decisions to leave below-ground structures in place would be made with concurrence from the EPA (as the lead regulatory agency) and DOE, based on the nature and extent of any residual contamination associated with the below-ground structure of the facility and known or suspected information on the nature and extent of underlying contamination.

Water would be used to control dust during demolition activities. Recognizing a need to limit infiltration into underlying 100-KR-1/100-KR-2 OU waste sites, water would be applied in a fine mist to achieve adequate dust control while minimizing the overall amount of water used.

To the extent possible based on the nature of contaminants and the ability to prevent spread of contamination, heavy equipment would be moved from one facility to the next, with little or no decontamination of the equipment between facilities. When decontamination is required for equipment release or transfer to the next facility, standard industry and best management practices would be used. Spent decontamination water and associated contamination may be discharged to the ground in accordance with the requirements of the project removal action work plan (RAWP) provided to EPA for review and approval. In certain circumstances (e.g., large volumes or at locations where there is known subsurface soil contamination) the water would be contained for treatment and disposal, as appropriate.

### **4.2.3 Residual Contamination**

After completing the D&D portion of this alternative, residual contamination may exist in the subsurface structures and/or underlying soil. This residual contamination may be from a known 100-KR-1/100-KR-2 OU waste site or from an area where subsurface contamination was not previously known to exist. The deactivation/D&D alternative methodology that would be used to handle these situations is described in the following subsections.

**4.2.3.1 Known 100-KR-1/100-KR-2 OU Waste Sites.** As established previously, there may be contaminated waste sites beneath and adjacent to some of the facilities included in the scope of this EE/CA. Those sites will be remediated under the authority of the 100-KR-1/100-KR-2 OU remedial action project, subsequent to the completion of facility removal actions in the area. Although outside the scope of removal actions associated with this EE/CA, the EPA and DOE may elect to coordinate excavation of 100-KR-1/100-KR-2 OU waste sites with D&D activities

**4.2.3.2 Newly Discovered Contamination.** During characterization or D&D, previously unknown contamination may be discovered. The degree to which newly discovered subsurface contamination (either structures or soil not previously included in the 100-KR-1/100-KR-2 OU scope) would be addressed during D&D will depend on a number of factors that include the following:

- Nature and extent of contamination
- Proximity to other 100-KR-1/100-KR-2 OU waste sites
- Anticipated schedules for 100-KR-1/100-KR-2 OU remedial action operations in the vicinity
- Projected life-cycle cost based on immediate removal compared to deferment under the remedial action program.

If newly discovered contamination is not remediated by the D&D program (in accordance with the 100-KR-1/100-KR-2 remedial action objectives), the newly discovered contamination will be, at a minimum, reported in WIDS. Final remediation of these sites will be performed as a part of the 100-KR-1/100-KR-2 remedial action program or other remediation activity.

### **4.2.4 Current-Year Cost**

A current-year cost estimate for the deactivation/D&D alternative was calculated from independent deactivation and D&D estimates. Several of the 100-K ancillary facilities in the scope of this EE/CA have been deactivated. Deactivation current-year costs were estimated for facilities where deactivation has not been conducted or is incomplete. Deactivation costs include labor, materials and supplies, equipment, subcontractor services, waste disposal costs, overhead, and contingency for each facility or group of facilities. The required deactivation activities and associated costs were estimated by the project engineer for each facility where deactivation had not been completed. Some facilities have been deactivated and no costs were determined.

Estimates for D&D include costs for equipment, materials, other direct costs or subcontractor services (including all labor, supplies, equipment, overhead, profit, and bonds), and contingency. The D&D current-year costs were estimated using cost estimating computer models based on the Micro Computer-Aided Cost Engineering System.

Contingency costs for deactivation and D&D were calculated at 10% and were included in the total costs to address any unforeseen field conditions, delays, and/or uncertainties within the defined work scope.

The current-year cost estimates for deactivation and D&D of the facilities in the scope of this EE/CA are summarized in Table 4-1. Some of the facilities were grouped together for purposes of preparing cost estimates. The total current-year cost for implementing the deactivation/D&D alternative for the 27 facilities included in the scope of this EE/CA is estimated to be \$27.7 million, based on present-day (2004) dollars. The present-worth estimate for deactivation and D&D is \$25.5 million. The present-worth value was determined through a calculation using the 7-year real interest rate on treasury notes and bonds from OMB Circular A-94, Appendix C (OMB 1992). The actual interest rate is 2.4%. More detailed information on the deactivation and D&D estimated costs is presented in Appendix B.

#### **4.3 ALTERNATIVE THREE – SURVEILLANCE AND MAINTENANCE (FOLLOWED BY DEACTIVATION/D&D)**

Alternative three consists of S&M of the 27 facilities for the purpose of maintaining the facilities in minimum safe condition, followed by deactivation/D&D to ready the area for remedial action. The deactivation/D&D phase for these facilities would be implemented as described in Section 4.2 by the year 2030. The year 2030 was selected to represent a reasonable period of time for continued S&M.

##### **4.3.1 General Surveillance and Maintenance**

During the S&M phase of this alternative, existing institutional controls would be maintained to warn area workers of potential hazards and to restrict public access to the 100-K Area. Access to specific facilities with substantial radiological contamination would be restricted for nonradiological workers. The S&M measures would include routine radiological and hazard monitoring of the facilities, periodic safety inspections, and basic facility maintenance (as required), based on the condition of each specific facility. Activities would be balanced to reduce worker hazards and the potential for contaminant release. Major repairs such as reroofing and shoring structural components would be performed, as necessary, to ensure facility integrity for containment of hazardous substances within the structure.

In general, as facilities age and deteriorate, S&M must become more aggressive, and worker safety is a critical factor. Without an increasingly aggressive S&M program, the threats associated with unplanned releases to the environment and injury or exposure to workers would increase. Conversely, an aggressive S&M program would require more frequent worker entry into the facilities to perform more invasive maintenance procedures, which would increase the

potential for exposure to workers. In addition, personal protection requirements to maintain a more aggressive program could continually increase, which would add to the cost. The need for upgrades to the infrastructure (e.g., electrical, sewer, and water systems) may also be anticipated in the out-years of the S&M period.

The cost of S&M for the 27 facilities in the scope of this EE/CA through 2030 was estimated based on the actual S&M costs incurred for these facilities during fiscal year 2003. The cost of the S&M program for the 100-K Area facilities during 2003 was approximately \$300,000. This includes all management and overhead costs to operate the program. The estimated current-year cost for the 100-K Area ancillary facilities' S&M program from 2005 to 2030 (26 years) is \$7.8 million.

#### **4.3.2 Roof Maintenance and Replacement**

Roofs typically require replacement or resurfacing approximately every 10 years. For the purposes of this EE/CA it was assumed that reroofing would be necessary two times during the S&M period. The cost of reroofing the facilities was estimated based on the total square-foot area of the building roofs, times either \$10 per square foot for nonradioactive facilities or \$15 per square foot for radioactive facilities. Based on these values, the estimated cost of reroofing the facilities in the scope of this EE/CA is \$665,500 every 10 years. Therefore, the estimated current-year cost of reroofing the facilities during the duration of the S&M period is \$1.3 million.

#### **4.3.3 Total Current-Year Cost**

Based on the calculations above, the total current-year cost of S&M (including roof maintenance and repair) for the 100-K Area facilities from 2005 through 2030 is \$9.1 million. Following the S&M phase of this alternative, the facilities would undergo deactivation and D&D. The deactivation and D&D phase of the alternative would be performed as described in Section 4.2. Current-year costs for the deactivation/D&D phase were calculated as described in Section 4.2 and were estimated to be \$ 27.7 million.

The total estimated current-year cost of implementing the S&M (followed by deactivation/D&D) alternative for the 27 facilities included in the scope of this EE/CA would be \$36.8 million, based on present-day (2004) dollars. The present-worth estimate for the S&M alternative is \$16.2 million. The present-worth value was determined through a calculation using the 30-year real interest rate on treasury notes and bonds from OMB Circular A-94, Appendix C (OMB 1992). The actual interest rate is 3.5%.

### **4.4 COMMON ELEMENTS**

Common elements that are shared between the deactivation/D&D alternative and the S&M alternative include historical properties management and waste management, as discussed in the following subsections.

## Identification of Removal Action Alternatives

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### 4.4.1 Historical Properties Management

The deactivation/D&D alternative and the S&M alternative share a common end state that would result in the demolition and disposal of all facilities included in the scope of this EE/CA.

As presented in Section 2.1.4, five of the facilities within the scope meet the NHPA criteria for consideration as historically significant properties. Assessments of the identified properties have been completed. Physical effects to these eligible properties, up to and including demolition, have been mitigated. Artifacts marked for retention within 105-KE, 105-KW, and 190-KW (two items) will need to be retrieved and transported to an appropriate curation facility before any demolition activities commence.

### 4.4.2 Waste Management

The deactivation/D&D alternative and the S&M alternative would each generate waste that requires disposal at appropriate disposal sites. Opportunities for waste minimization and pollution prevention would be evaluated to the extent practicable for each alternative. Materials that can be effectively decontaminated, and noncontaminated waste that can be effectively segregated from contaminated waste, may be recycled or sent to an approved offsite facility for disposal. Noncontaminated water encountered during the removal action could be used for dust suppression.

Waste for which no reuse, recycle, or decontamination options are identified would be assigned an appropriate waste designation (e.g., solid, asbestos, PCB, radioactive, dangerous, or mixed) and disposed of accordingly. The preferred pathway for disposal of contaminated waste would be the ERDF. Construction and operation of the ERDF was authorized by the *Record of Decision for the Environmental Restoration Disposal Facility* (EPA 1995). The ERDF is an engineered structure located on the Hanford Site designed to meet RCRA minimum technological requirements for landfills, including standards for a double liner, a leachate collection system, leak detection, and a final cover.

In 1996, an explanation of significant difference (ESD) (Ecology et al. 1996) clarified the ERDF ROD (EPA 1995) for eligibility of waste generated during Hanford Site cleanup activities. In accordance with the ESD, any low-level waste, mixed waste, or hazardous/dangerous waste generated as a result of CERCLA or RCRA cleanup actions (e.g., D&D, RCRA past-practice, and investigation-derived wastes) is eligible for ERDF disposal, provided that appropriate CERCLA decision documents are in place and that the waste meets *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (BHI 2002). Consequently, contaminated waste generated during the removal action proposed in this EE/CA would be eligible for disposal at the ERDF. Previous EE/CAs for other Hanford Site facilities have shown that the ERDF provides a high degree of protection for human health and the environment and is more cost effective than other disposal site options for comparable waste. Estimated waste volumes that would be generated for disposal at the ERDF would not be expected to significantly impact ERDF capacity limitations. The waste volumes in this document have been taken into consideration for ERDF planning purposes. Further discussions of the construction and operation of the ERDF are not within the scope of this EE/CA.



The preamble to 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 100 Area sites addressed by this EE/CA are reasonably close to one another, and the wastes are compatible for the selected disposal approach. Therefore, the sites are considered to be a single site for response purposes.

While most waste generated during the removal action is anticipated to meet ERDF waste acceptance criteria, some waste may require treatment before disposal. In most cases, the type of treatment anticipated would consist of solidification/stabilization techniques such as macroencapsulation or grouting. For waste that cannot be sent to the ERDF, it is expected that treatment, storage, or disposal can occur at other Hanford Site facilities such as the Central Waste Complex or the Effluent Treatment Facility. For waste that will be sent to the Central Waste Complex or Effluent Treatment Facility for treatment and/or disposal, the facilities will be considered as offsite CERCLA facilities. For waste encountered that must be sent off site for treatment or disposal, the EPA would establish an acceptability determination for proposed facilities in accordance with 40 CFR 300.440.

## Identification of Removal Action Alternatives

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Table 4-1. Deactivation/Decontamination and Decommissioning Cost Summary.

Facility	Description	Deactivation <sup>a</sup> (\$K)	D&D <sup>a</sup> (\$K)	Total <sup>a</sup> (\$K)
110-KW	Gas Storage	\$10.1	\$208.2	\$218.3
115-KW	Gas Recirculation Building	\$110.1	\$2,265.2	\$2,375.3
116-KW	Reactor Stack	NA	\$346.5	\$346.5
117-KW	Exhaust Air Filter Building	\$10.0	\$1,008.0	\$1,018.0
118-KW-2	Horizontal Control Rod Storage Cave	\$2.1	\$310.8	\$312.9
119-KW	Exhaust Air Sampling Building	\$3.0	\$302.8	\$305.8
166-KW	Oil Storage Vault	\$201.1	\$1,309.7	\$1,510.8
183-KW	Chlorine Car Protection Building	\$4.5	\$495.8	\$500.3
183.1-KW	Headhouse	\$139.7	\$1,443.0	\$1,582.7
183.2-KW	Sedimentation Basins	\$2.6	\$2,823.2	\$2,825.8
183.3-KW	Filter Basins	NA	\$2,510.7	\$2,510.7
183.4-KW	Reservoir and Clearwells	NA	\$1,689.8	\$1,689.8
183.5-KW	Lime Feeder Building	NA	\$246.9	\$246.9
183.6-KW	Lime Feeder Building	NA	\$246.9	\$246.9
183.7-KW	Pipe Tunnel	Costs included in estimates for the 183.2-KW, 183.3-KW, and 183.4-KW facilities		
190-KW	Process Water Pumphouse	\$190.3	\$2,728.2	\$2,918.5
110-KE	Gas Storage	\$12.0	\$208.2	\$220.2
115-KE	Gas Recirculation Building	\$110.1	\$2,040.8	\$2,150.9
116-KE	Reactor Stack	\$0	\$346.5	\$346.5
117-KE	Exhaust Air Filter Building	\$10.0	\$1,008.0	\$1,018.0
118-KE-2	Horizontal Control Rod Storage Cave	\$2.1	\$310.8	\$312.9
166-KE	Oil Storage Vault	\$201.1	\$1,309.7	\$1,510.8
1614-KE	Environmental Monitoring Station	\$4.5	\$207.1	\$211.6
182-K	Emergency Water Pumphouse	\$96.1	\$530.8	\$626.9
1701-K	Patrol Headquarters	Costs included in estimates for the 1720-K facility		
1720-K	Office and Telephone Exchange	\$77.3	\$1,154.6	\$1,231.9
1909-K	Effluent Valve Pits (two pits, one at each reactor)	\$4.5	\$1,458.7	\$1,463.2
<b>Current-Year Total Cost</b>		\$1,191.2	\$26,510.9	\$27,702.1
<b>Present-Worth Total Cost</b>				\$25,530.0

<sup>a</sup> Costs are in 2004 dollars.

NA = not applicable



## 5.0 ANALYSIS OF REMOVAL ACTION ALTERNATIVES

In accordance with CERCLA requirements, removal action alternatives are evaluated against the following three criteria:

1. Effectiveness
2. Implementability
3. Cost.

Each criterion is briefly summarized in Table 5-1.

A detailed analysis of the no action, deactivation/D&D, and S&M alternatives being considered in this EE/CA relative to each criterion is provided in the following subsections, followed by a comparison of the alternatives against one another relative to each criterion. Results of the evaluation will be used to identify a preferred removal action alternative. Public acceptance of the preferred alternative will be evaluated when the public is given an opportunity to review and comment on this EE/CA. State acceptance will be evaluated by Ecology. After addressing comments, the DOE will document the selected removal action in an action memorandum.

### 5.1 EFFECTIVENESS

In order to provide a more comprehensive evaluation in this EE/CA, the effectiveness criterion has been divided into several subcategories. A description of the subcategories is presented in Table 5-1. The following subsections evaluate each of the effectiveness subcategories.

#### 5.1.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is the primary objective of the removal action. This criterion addresses whether the action achieves adequate overall elimination, reduction, or control of risks to human health and the environment posed by the likely exposure pathways. This criterion must be met for a removal action to be eligible for consideration. Evaluation of the alternatives against this criterion is based on qualitative analysis and assumptions regarding the inventory of hazards in the facilities to be addressed by the removal action.

The no action alternative would not eliminate, reduce, or control risks to human health and the environment. Because implementation of this alternative would not meet removal action objectives or the threshold criterion for overall protectiveness, it cannot be considered a viable alternative. Consequently, the no action alternative was not carried forward for further evaluation.

The other two alternatives would both meet the threshold criterion for overall protection of human health and the environment. In the deactivation/D&D alternative, hazardous substances would be removed so that the facilities do not present a risk to workers and do not obstruct

remediation of 100-KR-1/100-KR-2 waste sites. Facilities would be monitored and maintained under the S&M alternative to control releases of hazardous substances. In addition, public and worker access would be restricted until deactivation and D&D are implemented. Remediation of the 100-KR-1/100-KR-2 OU waste sites would be delayed until the facilities undergo deactivation and D&D. Both alternatives would achieve the same end state, but the S&M alternative would take longer.

### **5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements**

This criterion addresses whether a removal action will, to the extent practicable, meet ARARs and other federal and state environmental statutes. The ARARs must be met for onsite CERCLA actions (CERCLA, Section 121[d][2]). Onsite actions are exempted from obtaining federal, state, and local permits (CERCLA, Section 121[e][1]). Nonpromulgated standards are also to be considered, such as proposed regulations and regulatory guidance, to the extent necessary for the removal action to be adequately protective. The ARAR criterion must be met for an alternative to be eligible for consideration.

Key ARARs associated with the two remaining alternatives include waste management standards, standards controlling releases to the environment, and standards for protection of cultural and ecological resources. The actions proposed for both alternatives would meet these preliminary ARARs, although the potential for noncompliance with standards for controlling releases to the environment could increase as the facilities age under the S&M alternative. A detailed discussion of how the removal action alternatives would comply with ARARs is provided in Appendix C, including other advisories or guidance documents to be considered. Final ARARs to be met during implementation of the selected removal action will be documented in the CERCLA action memorandum associated with this EE/CA.

### **5.1.3 Long-Term Effectiveness and Permanence**

The long-term effectiveness and permanence criterion addresses whether the alternative leaves an unacceptable risk after the removal action has been taken. It also refers to the ability of a removal action to maintain long-term, reliable protection of human health and the environment after removal action objectives have been met.

The deactivation/D&D alternative would be protective of human health and the environment for the long term and would provide a permanent removal action for the facilities covered by this EE/CA in the early years of implementation. Structures would be removed and disposed at approved facilities, such as the ERDF or offsite landfills, based on the presence or absence of contamination, thereby creating an effective and permanent removal action with regard to the facilities.

The S&M alternative would eventually be as effective as the deactivation/D&D alternative in protecting human health and the environment in the long term, although the efforts to maintain that level of protection would necessarily become increasingly aggressive as the facilities age during the interim S&M period. Because contamination would be left in place for up to 26 years with this alternative, the risk of exposure and release would remain and could increase with time.

## Analysis of Removal Action Alternatives

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Consequently, the deactivation/D&D alternative is considered to achieve long-term protectiveness more effectively than the S&M alternative because a permanent removal action for the facilities would be achieved earlier.

### 5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment technologies may be employed in a removal action. This criterion assesses whether the alternative permanently and significantly reduces the hazard posed through application of a treatment technology. Destroying the contaminants, reducing the quantity of contaminants, or irreversibly reducing the mobility of contaminants could accomplish this. Reduction of toxicity, mobility, and/or volume through treatment contributes to overall protectiveness.

Both the deactivation/D&D and S&M alternatives would generate waste that might require treatment to meet waste acceptance criteria at the ERDF or other disposal facilities. However, the fraction of waste requiring treatment would likely be low, and neither alternative would involve a specific treatment technology as part of the removal action. The volume of waste requiring treatment would be the same for both alternatives. Therefore, neither toxicity, mobility, nor volume would be significantly reduced through treatment with either alternative, and both alternatives would be equally effective for this criterion. Both alternatives would involve segregation activities and employ recycling options for noncontaminated material to reduce the volume of material disposed.

### 5.1.5 Short-Term Effectiveness

The short-term effectiveness criterion refers to an evaluation of the speed with which the remedy achieves protection. The criterion also refers to any potential adverse effects on human health and the environment during the implementation phases of the removal action.

There would be a potential for worker exposure and releases to the environment in implementing either the deactivation/D&D or S&M alternatives. Early in the implementation period, there would be greater potential exposure to humans with the deactivation/D&D alternative because Hanford Site workers would be entering contaminated facilities and would be handling contaminated materials as part of the removal action. Handling the contaminated materials would also increase the potential for a release to the environment, especially to the air. Adherence to all appropriate environmental regulations would ensure that the potential for release would be minimized. Effective planning, limiting time in contaminated areas, and providing the necessary protective clothing and equipment appropriate to the tasks would mitigate the risk to workers. Contaminated materials would be removed and disposed at the ERDF or other approved disposal facilities, reducing the potential for a contaminant release.

The S&M alternative would present less risk to workers and the environment in the near term because it would involve fewer intrusive activities that could result in contaminant releases. As Hanford Site workers enter the contaminated facilities to perform S&M activities, there would be a potential for personnel exposure that would become greater as the facilities deteriorate and the need for increased activities and major repairs arises. There would be a

further increase in worker exposure and the potential for a release when the facilities finally undergo deactivation and D&D within 26 years.

Both alternatives ultimately achieve the same end state. Because this end state would be achieved earlier by implementing the deactivation/D&D alternative, it is considered more effective in achieving protectiveness in the short term.

## **5.2 IMPLEMENTABILITY**

Implementability refers to the technical and administrative feasibility of a removal action, including the availability of materials and services needed to implement the selected solution.

The deactivation and D&D elements of both alternatives are implementable. Environmental restoration workers at the Hanford Site are experienced in performing deactivation/D&D activities and waste disposal operations. Techniques and lessons learned from previous successful projects would be applied to planning and execution of field work. The personnel skills required to implement the alternatives are readily available within the existing work force at the Hanford Site. Materials and equipment that would be needed are easily obtained. In terms of waste disposal, the ERDF has been in operation for several years, and procedures for handling CERCLA waste are well established. Offsite disposal is available for noncontaminated material that is segregated during field operations. No specialized materials, equipment, or services would be required.

The initial phase of the S&M alternative would be implementable, although it may present technical challenges as time passes. S&M techniques are widely used throughout the Hanford Site, and no specialized materials or services would be required, except when major repairs would be needed on a contaminated facility. As time passes, the primary difficulty with implementation would be the increasing age of the facilities and challenges to maintain integrity and prevent contaminant releases as they deteriorate. The poor condition of the facilities would present increased risk to workers entering the facilities to perform maintenance and/or major repairs. The Hanford Site work force may decrease during the S&M period, affecting the availability of a trained work force when the facilities finally undergo D&D. Because minimum specialized skills would be required for deactivation/D&D activities, construction labor forces could be drawn from the surrounding community, if necessary. It is assumed that the ERDF and other offsite landfills would still be operational and available to support waste management needs for contaminated and noncontaminated materials.

With facility removal deferred until at least 2030, the S&M alternative could present an implementation issue with respect to maintaining remediation progress because access to some of the 100-KR-1/100-KR-2 OU waste sites may not be available until that time.

Overall, the deactivation/D&D alternative would be more implementable than the S&M alternative because it would not involve the technical challenges associated with continued maintenance of aging facilities. It would also facilitate more timely cleanup of the 100-KR-1/100-KR-2 OU waste sites in the geographical area.

## Analysis of Removal Action Alternatives

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### 5.3 COST

The cost criterion evaluates the cost of the alternatives and includes capital, operation and maintenance, and monitoring costs. All of the costs included in this document are estimates. Further refinement of the costs will be developed in accordance with the design documentation that will be prepared to complete action.

Total current-year costs of implementing the deactivation/D&D and S&M alternatives for the 27 facilities included in the scope of this EE/CA would be \$27.7 million and \$36.8 million, respectively. The deactivation/D&D alternative would be more cost effective because the same end state would be reached, without the unnecessary cost associated with the additional phase of the S&M alternative.

### 5.4 OTHER CONSIDERATIONS

Secretarial policy (DOE 1994) and DOE O 451.1B require that CERCLA documents incorporate NEPA values such as analysis of cumulative, offsite, ecological, and socioeconomic impacts to the extent practicable, in lieu of preparing separate NEPA documentation for CERCLA activities. The NEPA regulations (40 CFR 1502.16) specify evaluation of the environmental consequences of proposed alternatives. These include the following potential effects:

- Transportation resources
- Air quality
- Cultural and historical resources
- Noise, visual, and aesthetic effects
- Environmental justice
- Socioeconomic aspects of implementation.

The NEPA process also involves consideration of several issues such as cumulative impacts (direct and indirect), mitigation of adversely impacted resources, and the irreversible and irretrievable commitment of resources. A NEPA values evaluation of the deactivation/D&D and S&M alternatives is presented in the following subsections. The no action alternative is excluded from the evaluation because it failed to meet the overall protection threshold criterion documented in Section 5.1.1.

#### 5.4.1 Transportation Impacts

Neither of the removal alternatives would be expected to create any long-term transportation impacts. Both alternatives would likely have short-term impacts on local Hanford Site traffic associated with transportation of waste, equipment, and personnel during the deactivation and D&D period. Demolition debris and contaminated soil would be transported from the 100-K Area to the ERDF. Both alternatives would also require hauling geologic material to the 100-K Area for backfill. The quantities transported would be the same in both alternatives, but would occur later for the S&M alternative. All waste transportation would occur on the Hanford



## Analysis of Removal Action Alternatives

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Site, primarily on roads where public access is restricted. Where use of public roads is required, temporary road closures and/or off-hour shipments could be coordinated. No modifications to the existing Hanford Site transportation infrastructure would be required to support waste shipments. Minimal offsite impacts would be expected from transportation of waste to offsite sanitary landfills.

Both alternatives would also involve transportation impacts from supplying equipment and materials to the 100-K Area and from increases in the workforce traffic. Transportation impacts related to supplies and work force would be expected to be similar for these alternatives and would have minimal impact on the transportation infrastructure.

If adverse impacts to transportation were to be detected, activities would be modified or halted until the impact is mitigated. Potential mitigation measures for transportation include preparing a transportation safety analysis to identify the need for specific precautions to be taken before any transport activities, closing roads during waste transportation, or use of the existing rail infrastructure.

### 5.4.2 Air Quality

Potential air quality impacts are associated with each alternative that have not been quantified, but these impacts would be expected to be minor. Both alternatives would have potential air quality impacts associated with fugitive emissions of contaminants during facility demolition. There also would be potential dust emissions associated with excavation of backfill at borrow sites and placement of the material in the 100-K Area. Impacts would be the same for the two alternatives, but would occur later for the S&M alternative. Potential emissions would be quantified during design to ensure that emissions are controlled to below allowable limits. No impacts on local or regional air quality would be expected as long as appropriate fugitive emission and dust control measures are implemented. Potential mitigation measures for air resources include the following:

- Removing or stabilizing facility contaminants before demolition
- Using local exhaust and containment systems during demolition
- Packaging and handling wastes to prevent releases
- Implementing dust-suppression measures (both water and water treated with fixatives) to control fugitive dust
- Covering loads when hauling wastes and backfill materials
- Preparing an air monitoring plan before beginning field work.

### 5.4.3 Natural, Cultural, and Historical Resources

**5.4.3.1 Natural Resources.** Natural resources include biological resources such as wildlife habitat, plants, and animals; physical resources such as land, water, and air; and human resources such as remediation workers. As documented in Section 2.0, the area within the 100-K Area

perimeter road is highly disturbed from industrial operations and does not include any sensitive biological areas. Potential impacts to biological resources would be a greater concern at facilities located outside the perimeter road (181-KW River Pumphouse, 181-KE River Pumphouse, and 1908-KE Outfall) and borrow sites because they could be located in otherwise undisturbed areas. Potential adverse impacts at the ERDF, which is located in an area of high-quality shrub-steppe habitat, were addressed in the *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility* (DOE-RL 1994). Both alternatives would also have positive impacts on biological resources because the potential for exposure to contaminants would be minimized through removal. Potential impacts to air resources were discussed previously. For both alternatives, there is also a potential for impacts to land and water resources if contaminants were to be released during the removal action. As facilities are demolished, there would be a potential for precipitation to contact contaminants and carry them to the soil, where they could then migrate to groundwater. Measures that would be implemented to mitigate potential impacts include the following:

- Stockpiling clean topsoil during site preparation for use as backfill
- Minimizing the size of construction areas
- Performing ecological surveys before remediation
- Avoiding work in the area of a nest during the nesting season
- Locating borrow sites in areas that would only impact low-quality habitat such as cheatgrass
- Revegetating disturbed areas (as applicable)
- Making borrow sites deeper to minimize the lateral extent of disturbance
- Providing engineering/administrative controls and protective equipment for workers.

**5.4.3.2 Cultural Resources.** Cultural resources are unlikely to be encountered during activities at facilities located within the 100-K Area perimeter road because this area is heavily disturbed from past operations, as discussed in Section 2.0. Cultural resources might be present at facilities located outside the perimeter road and borrow sites, which are typically located in otherwise undisturbed areas. Adverse impacts to cultural resources could occur if such resources are encountered and appropriate mitigating actions are not taken. A cultural resource mitigation plan has been prepared to guide activities, including avoiding known cultural resources and traditional-use areas whenever possible, conducting cultural resource reviews before subsurface intrusion or building demolition, and training construction workers to recognize and report potential cultural resources. If cultural resources are encountered, the State Historic Preservation Office and Native American tribes would be consulted to determine appropriate actions for mitigation, resource documentation, or recovery.

**5.4.3.3 Historical Resources.** As documented in Section 2.0, several facilities in the 100-K Area meet the NHPA criteria for consideration as historically significant properties. A programmatic agreement (DOE-RL 1996) requires that DOE assess the contents of the historic buildings and structures before any future deactivation, decontamination, or decommissioning activities can be conducted. An associated treatment plan (DOE-RL 1998a) identifies those facilities, including facilities in the 100-K Area, recommended for individual documentation. As described in Section 2.1.4, appropriate documentation has been completed for the contributing facilities in the 100-K Area. Interior assessments of the 100-K facilities have been

conducted to identify and tag artifacts that may have interpretive or educational value. Tagged items would be removed from facilities and transferred to safe storage before any activity took place that would disrupt such items.

#### **5.4.4 Noise, Visual, and Aesthetic Effects**

Both alternatives would increase noise levels, but the impacts would be of short-term duration during removal actions and would not affect offsite noise levels. Positive impacts on visual and aesthetic effects would be realized, but the benefits would occur earlier with the deactivation/D&D alternative. The existing above-grade structures of the facilities addressed in this EE/CA would be removed, and the sites would be backfilled and contoured to natural grade.

#### **5.4.5 Socioeconomic Impacts**

The local economy is closely tied to Hanford Site employment, so changes in the work force associated with the facilities addressed in this EE/CA could potentially affect local socioeconomics, although impacts would be relatively small compared to the current Hanford work force. The number of full-time equivalent workers required in a given year to support the removal actions would be on the order of a few dozen. The alternatives would meet the principles established by the Hanford Advisory Board Work Group for cultural/socioeconomic impacts and allow for workforce transition to cleanup activities. Effects on community social services, public services, and recreation would probably be imperceptible because so few employees would be involved. No mitigation measures have been identified for socioeconomics.

#### **5.4.6 Environmental Justice**

Health or socioeconomic impacts to any of the local communities would be minimal for both alternatives, so environmental justice issues (i.e., high and disproportionate adverse health and socioeconomic impacts on minority or low-income populations) would not be a concern.

#### **5.4.7 Irreversible and Irretrievable Commitment of Resources**

Removal actions at the facilities included in the scope of this EE/CA could require an irreversible or irretrievable commitment of resources, particularly land use and geologic materials.

Under both alternatives, there would be a loss of land use because land area at the ERDF would be irretrievably committed for disposal of D&D waste. Disposal of waste cannot be avoided, and the ERDF is designed to minimize land committed for disposal. Irretrievable land commitment at the ERDF is mitigated by a substantial gain in land use at the sites where the facilities are located and a reduction of risk of contaminant exposure to the natural resources at the 100-K Area. The facilities would eventually be removed. In combination with future soil cleanup, this would allow for unrestricted future surface use at these sites as defined by the remedial action program. Contamination above cleanup standards might remain at depth, even after soil contamination is addressed in accordance with the remedial action program requirements, and this would require restrictions on deep excavations and well drilling.

However, achieving unrestricted surface use at the sites would substantially benefit the natural resources as compared to current use restrictions. The S&M alternative would require additional land-use restrictions during the interim phase, until deactivation/D&D is performed.

Both alternatives would also require an irretrievable and irreversible commitment of resources in the form of petroleum products (e.g., diesel fuel and gasoline) and geologic materials required to backfill and recontour the sites following D&D. Geologic material would be obtained from onsite borrow pits. To the extent practicable, measures would be taken to minimize the quantity of backfill required. Quantities of required petroleum and geologic resources would be the same for both alternatives. In addition, there would be a small increase in the amount of material required for the closure barrier at the ERDF.

#### **5.4.8 Cumulative Impacts**

Removal actions at the facilities included in the scope of this EE/CA could have impacts when considered together with impacts from past and foreseeable future actions at and near the Hanford Site. Authorized current and future activities in the 100-K Area that might be ongoing during removal actions include soil and groundwater remediation, removal and storage of SNF from the K Basins, and S&M of facilities. Other Hanford Site activities include D&D of a variety of facilities, soil and groundwater remediation, operation and closure of underground waste tanks, construction and operation of tank waste vitrification facilities, and operation of the Energy Northwest commercial reactor. Activities near the Hanford Site include a privately owned radioactive and mixed waste treatment facility, a commercial fuel manufacturer, and a titanium reprocessing plant.

Both removal action alternatives would have minimal impacts on transportation; air quality; natural, cultural, and historical resources; noise, visual, and aesthetic effects; public health; and socioeconomics. Therefore, cumulative impacts with respect to these values are expected to be insignificant. Cumulative impacts could occur with respect to the irretrievable and irreversible commitment of resources and funding priority.

Both alternatives would require excavation of geologic material from borrow sites for backfill and cover, resulting in an irretrievable and irreversible commitment of geologic materials. The proposed 100-K Area actions constitute only one of numerous actions requiring material for barriers and backfill at the Hanford Site. The total quantity of geologic materials required for Hanford Site actions was evaluated in separate NEPA documentation.

Both alternatives could also require long-term land-use restrictions in the 100-K Area in the form of restrictions on subsurface access. As documented in Section 2.0, the future land use in the 100 Area is anticipated by DOE to be preservation/conservation. Consequently, the land-use restrictions that would be imposed by either alternative would be compatible with other decisions and would not result in a cumulative impact for land use.

Table 5-1. Summary of Evaluation Criteria.

Effectiveness <sup>a</sup>	<b>Overall Protection of Human Health and the Environment.</b> The primary objective and a “threshold” criterion that must be met for a removal action to be eligible for consideration. This criterion addresses whether the alternative achieves adequate overall elimination, reduction, or control of risks to human health and the environment posed by the likely exposure pathways. Assessments of the other evaluation criteria are also drawn upon. Evaluation of the alternatives against this criterion was based on qualitative analysis and assumptions regarding the inventory of hazards in the 27 facilities to be addressed by this removal action.
	<b>Compliance with Applicable or Relevant and Appropriate Requirements.</b> Like overall protection of human health and the environment, compliance with ARARs is a threshold criterion that must be met for an alternative to be eligible for consideration. This criterion addresses whether a removal action will, to the extent practicable, meet ARARs and other federal and state environmental statutes. The ARARs must be met for onsite CERCLA actions (CERCLA, Section 121[d][2]). Onsite actions are exempted from obtaining federal, state, and local permits (CERCLA, Section 121[e][1]). Nonpromulgated standards, such as proposed regulations and regulatory guidance, are also to be considered to the extent necessary for the removal action to be adequately protective.
	<b>Long-Term Effectiveness and Permanence.</b> The long-term effectiveness and permanence criterion addresses whether the alternative leaves an unacceptable risk after the removal action has been completed. It also refers to the reliability of a removal action to maintain long-term protection of human health and the environment after implementation.
	<b>Reduction of Toxicity, Mobility, or Volume Through Treatment.</b> The reduction of toxicity, mobility, or volume through treatment criterion refers to an evaluation of the anticipated performance for treatment technologies that may be employed in a removal action. It assesses whether the alternative permanently and significantly reduces the hazard posed through application of a treatment technology. This could be accomplished by destroying the contaminants, reducing the quantity of contaminants, or irreversibly reducing the mobility of contaminants. Reduction of toxicity, mobility, and/or volume contributes to overall protectiveness.
	<b>Short-Term Effectiveness.</b> The short-term effectiveness criterion refers to an evaluation of the speed with which the removal action achieves protection. The criterion also refers to any potential adverse effects on human health and the environment during the implementation phases of the removal action.
Implementability	Implementability refers to the technical and administrative feasibility of a removal action, including the availability of materials and services needed to implement the selected solution.
Cost	The cost criterion evaluates the cost of the alternatives and includes capital, operation and maintenance, and monitoring costs.

<sup>a</sup> To provide a more comprehensive evaluation, the effectiveness criterion has been divided into several subcategories.

## 6.0 RECOMMENDED ALTERNATIVE

The recommended alternative for the 27 facilities included in the scope of this EE/CA is deactivation/D&D. This alternative includes deactivation where needed, demolition of the facilities, removal of contaminated waste/demolition debris, and disposal of the material at the ERDF or another approved facility. Material that has been decontaminated or segregated as noncontaminated during implementation of the alternative may be recycled, sent to an appropriate offsite sanitary landfill, or used as fill elsewhere at the Hanford Site.

The deactivation/D&D alternative is recommended based on its ability to provide increased protection to human health and the environment and its effectiveness in maintaining that protection in both the short term and the long term. The alternative removes the threat to the public and the environment associated with exposure to unacceptable levels of radioactive contaminants under future land-use scenarios. In addition, the deactivation/D&D alternative would allow more timely implementation of the 100-KR-1/100-KR-2 OU remedial actions and would eliminate unnecessary costs and potential hazards associated with an extended S&M program and increasing age of the facilities.

The estimated current-year cost of implementing the deactivation/D&D alternative for the 27 facilities included in the scope of this EE/CA is \$27.7 million (constant fiscal year 2004 dollars).

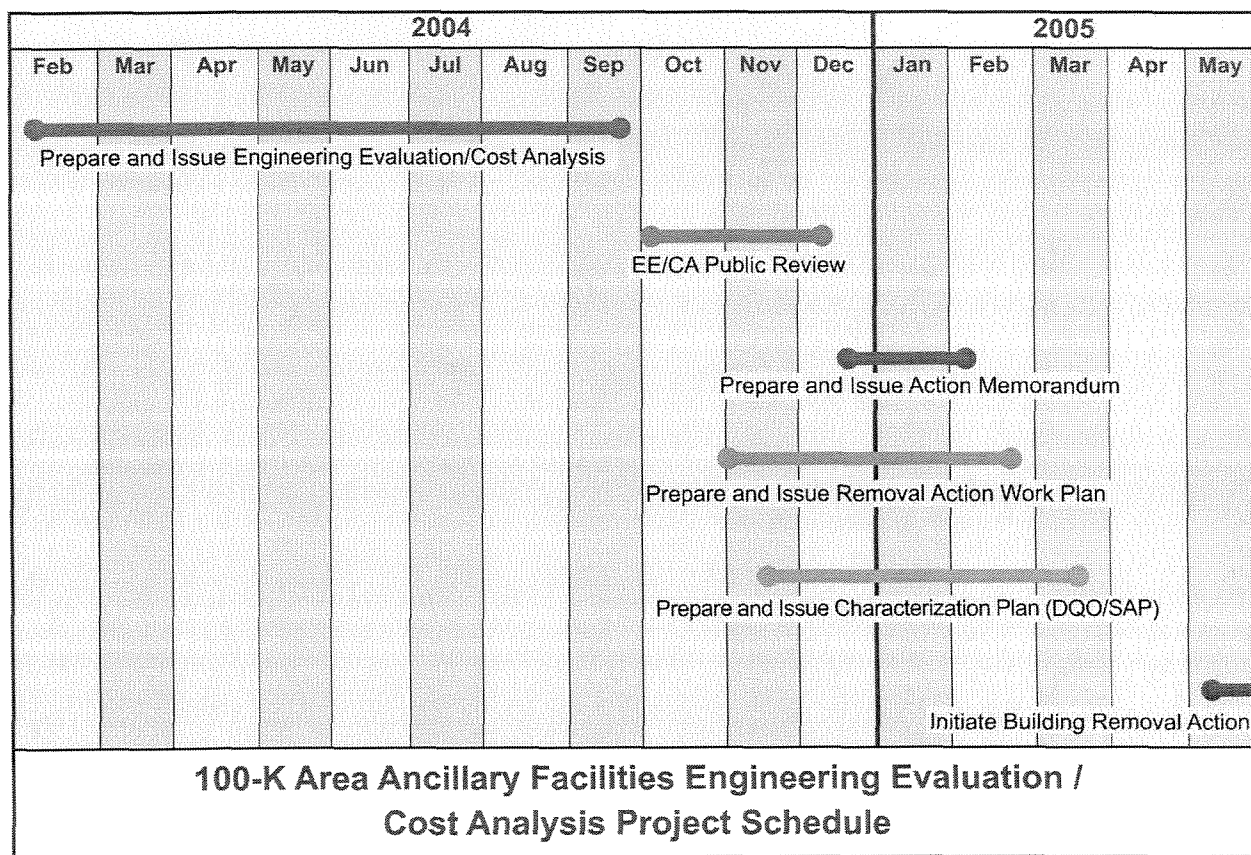


## 7.0 SCHEDULE

For information purposes only, Figure 7-1 provides a schedule for the proposed removal action alternative. The sampling and analysis plan (for waste designation and final verification) and the RAWP will be submitted to the regulatory agencies for concurrence. A more detailed schedule for conducting the removal action will be included in the RAWP. The current planning baseline calls for completing the removal action in time to facilitate remediation of all sites in the 100-K Area by 2012.



Figure 7-1. Schedule.



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## 8.0 REFERENCES

- 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, as amended.
- 40 CFR 1502.16, "Environmental Impact Statement – Environmental Consequences," *Code of Federal Regulations*, as amended.
- 64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP-EIS)," *Federal Register*, Vol. 64, No. 218, pp. 61615, November 12, 1999.
- 65 FR 37253, "Establishment of the Hanford Reach National Monument," *Federal Register*, Vol. 65, p. 37253, June 9, 2000.
- BHI, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 U.S.C. 9601, et seq.
- DOE, 1994, *Secretarial Policy on the National Environmental Policy Act*, memorandum from H. O'Leary to Secretarial Offices and Heads of Field Elements, dated June 1994, U.S. Department of Energy, Washington, D.C.
- DOE and EPA, 1995, *Policy on Decommissioning Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, May 22, 1995, U.S. Department of Energy and U.S. Environmental Protection Agency, Washington, D.C.
- DOE O 451.1B, *National Environmental Policy Act Compliance Program*, as amended, U.S. Department of Energy, Washington, D.C.
- DOE-RL, 1994, *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility*, DOE/RL-93-99, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 1996, *Programmatic Agreement Among the U.S. Department of Energy Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site*, Washington, DOE/RL-96-77, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

## References

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- DOE-RL, 1998a, *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan*, DOE/RL-97-56, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 1998b, *Tri-Party Agreement Handbook Management Procedures*, RL-TPA-90-0001, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2002, *The Hanford Site Historic District*, DOE/RL-97-1047, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- Ecology, EPA, and DOE, 1996, *U.S. Department of Energy Environmental Restoration Facility, Hanford Site, Benton County, Washington, Explanation of Significant Difference*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.
- Ecology, EPA, and DOE, 1998, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.
- EPA, 1995, *Record of Decision for the Environmental Restoration Disposal Facility*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
- EPA, 1996, *Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units at the Hanford Site Interim Remedial Actions*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
- EPA, 1997, *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
- EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
- EPA, 2000, *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units Hanford Site (100 Area Burial Grounds)*, Hanford Site, Benton County, Washington, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
- Migratory Bird Treaty Act of 1918*, 16 U.S.C. 703, et seq.
- National Environmental Policy Act of 1969*, 42 U.S.C. 4321, et seq.

## References

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*National Historic Preservation Act of 1966*, 16 U.S.C. 470, et seq.

NPS, 1988, *The National Register of Historic Places*, National Park Service, U.S. Department of the Interior, Washington, D.C.

OMB, 1992, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular No. A-94, Office of Management and Budget, Washington, D.C.

*Resource Conservation and Recovery Act of 1976*, 42 U.S.C. 6901, et seq.

*Superfund Amendments and Reauthorization Act of 1986*, 42 U.S.C. 9601, et seq.



## 9.0 BIBLIOGRAPHY

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

40 CFR 1506, "Other Requirements of NEPA," *Code of Federal Regulations*, as amended.

PNL, 1989, *Hanford Cultural Resources Management Plan*, PNL-6942, Pacific Northwest Laboratory, Richland, Washington.

PNNL, 2003, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Rev. 15, Pacific Northwest National Laboratory, Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington State Administrative Code*, as amended.



## **APPENDIX A**

### **BUILDING DESCRIPTIONS**





## APPENDIX A

### BUILDING DESCRIPTIONS

#### A.1 INTRODUCTION

This appendix provides a detailed description of each facility within the scope of this engineering evaluation/cost analysis (EE/CA). The tables in this appendix summarize a number of characteristics, including facility name, number, location, size, construction, operational and process history, and waste characterization. The information within the tables was compiled from a variety of sources that include technical baseline reports, completion reports, and other facility documents. The tables provide information on 100-KW and 100-KE facilities, followed by 100-K Area common facilities.

**Table A-1. 110-KW Gas Storage Facility.**

<b>Name</b>	Gas Storage Facility
<b>Number</b>	110-KW
<b>WIDS Number</b>	NA
<b>Location</b>	East of the 105-KW Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The facility contained high-pressure helium tanks (60 cm [24 in.] in diameter by 24.4 m [80 ft] long) and four low-pressure tanks (1.8 m [6 ft] in diameter by 5.4 m [18 ft] long) that were used for carbon dioxide (UNI 1984, WHC 1994). The high-pressure tanks have been removed; however, the concrete supports remain. The building is 120 m <sup>2</sup> (1,296 ft <sup>2</sup> ) (GE 1964).
<b>Status/History</b>	The 110-KW Gas Storage facility is an outdoor unloading and gas storage area. This facility supported the 115-KW Building (BHI 1994, WHC 1988). A railroad spur and associated equipment for transferring gas at high pressure were used at the site.
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"><li>• Approximately 15 m (49.2 ft) southeast of 116-KW.</li><li>• Approximately 30 m (58.4 ft) southeast of 117-KW.</li></ul>
<b>Characterization</b>	In 1994, no radiation levels were detected above background.

NA = not applicable

WIDS = Waste Information Data System

## Appendix A – Building Descriptions

**Table A-2. 115-KW Gas Recirculation Building. (2 Pages)**

<b>Name</b>	Gas Recirculation Building
<b>Number</b>	115-KW
<b>WIDS Number</b>	NA
<b>Location</b>	East of the 105-KW Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The single-story building was 6 m (20 ft) above grade and 6 m (20 ft) below grade, with dimensions of 34 x 10 x 12 m (113 x 34 x 40 ft) tall with a total area of 360 m <sup>2</sup> (3,880 ft <sup>2</sup> ) (BHI 1994). The building was constructed with a reinforced-concrete foundation and floor, and corrugated transite slab roof with built-up asphalt and gravel (AEC-GE 1964, UNI 1984, WHC 1994).
<b>Status/History</b>	The 115-KW Gas Recirculation Building was designed to house gas circulation pumps, gas dryers, filters, heat exchangers, and related instruments and piping for the reactor gas coolant system (WHC 1988). The building was also designed to detect water leaks within the reactor cores. The facility contains heaters/coolers, gas dryer towers, condensers, filters, pumps, silica-gel drying beds, piping and ductwork, and heating and ventilation systems. In addition, it contains spindle-type helium storage tanks and a gas unloading room.
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 20 m (66 ft) south of 116-KW.</li> <li>• Approximately 30 m (100 ft) east of the 105-KW Reactor.</li> </ul>
<b>Characterization</b>	<p>In 1976, radiological readings on piping, condensate drains, valves, turbine blowers, and condensers in the drier rooms were about 10,000 cpm. Readings on the silica-gel towers ranged from 1,000 to 15,000 cpm. The highest radiation levels identified were on the condensers in the dryer room, where maximum readings were about 50,000 cpm. Direct dose rate readings on the condensers were 30 mR/hr. Background radiation levels were about 1,000 cpm.</p> <p>Dose rates in the filter room were about 1 mR/hr. Dose rates for the gas piping tunnels were about 1 mR/hr. Direct dose rate readings of the piping inside the tunnels ranged from 3 to 20 mR/hr.</p> <p>Standard smears collected in 1976 on the floor, the louvered air duct to the 105 Pipe Tunnel, floor at the silica-gel tower, and floor drain in room number 1 indicate the presence of the following:</p> <ul style="list-style-type: none"> <li>• Gas piping tunnel floor: H-3 (<math>1.2 \times 10^4</math> cpm), Co-60 (<math>2.1 \times 10^4</math> cpm), Cs-134 (<math>2.4 \times 10^1</math> cpm), Cs-137 (<math>2.5 \times 10^3</math> cpm), and C-14 (<math>4.3 \times 10^4</math> cpm)</li> <li>• Louvered air duct to 105 Pipe Tunnel: Pu-238 (<math>4.2 \times 10^1</math> cpm), Pu-239/240 (<math>4.7 \times 10^1</math> cpm), Co-60 (<math>3.2 \times 10^2</math> cpm), Cs-134 (<math>1.6 \times 10^1</math> cpm), and Cs-137 (<math>5.0 \times 10^4</math> cpm)</li> <li>• Floor at the silica-gel tower in room number 1: H-3 (<math>1.8 \times 10^3</math> cpm) and C-14 (<math>5.6 \times 10^3</math> cpm)</li> <li>• Floor at drain in dryer room number 1: Pu-238 (<math>7.1 \times 10^0</math> cpm), Pu-239/240 (<math>4.9 \times 10^0</math> cpm), Sr-90 (<math>4.2 \times 10^2</math> cpm), and Co-60 (<math>5.2 \times 10^1</math> cpm)</li> <li>• Floor at condensate pot dryer room number 2: Sr-90 (<math>2.1 \times 10^1</math> cpm) and Cs-137 (<math>6.0 \times 10^1</math> cpm)</li> <li>• Floor in dryer room number 2: H-3 (<math>1.4 \times 10^3</math> cpm) and C-14 (<math>2.5 \times 10^3</math> cpm)</li> </ul>

**Table A-2. 115-KW Gas Recirculation Building. (2 Pages)**

	<ul style="list-style-type: none"> <li>Floor at drain in dryer room number 2: Sr-90 (<math>2.0 \times 10^2</math> cpm), Co-60 (<math>1.1 \times 10^4</math> and <math>2.1 \times 10^3</math> cpm)</li> <li>Floor under silica-gel tower in dryer room number 2: Pu-238 (<math>8.1 \times 10^{-1}</math> cpm), Pu-239/240 (<math>6.0 \times 10^{-1}</math> cpm), Sr-90 (<math>6.0 \times 10^1</math> cpm), and Co-60 (<math>5.1 \times 10^3</math> cpm) (UNI 1978).</li> </ul> <p>In 1994, the equipment remained in place due to its contaminated condition. No radiation levels were detected around the exterior of the building. Interior radiation conditions are anticipated.</p>
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cpm = counts per minute

**Table A-3. 116-KW Reactor Stack. (2 Pages)**

<b>Name</b>	Reactor Stack
<b>Number</b>	116-KW
<b>WIDS Number</b>	132-KW-1
<b>Location</b>	Northeast side of the 105-KW Reactor building
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	<p>The 116-KW Reactor Stack was constructed of reinforced concrete and was originally 91 m (300 ft) high. It extended 5 m (16 ft) below grade and was 5 m (16 ft) in diameter. The base wall is 0.4 m (1.5 ft) thick at the base and 0.3 m (1 ft) thick at the top. The base is solid concrete 5.6 m (18.5 ft) side to side and 3.5 m (11.5 ft) thick, which rests on another concrete base that is octagonal and measures 8 m (27 ft) side to side and 1.8 m (6 ft) thick (BHI 1994). The stack contained <math>215.7 \text{ m}^3</math> (282 <math>\text{yd}^3</math>) of concrete and 8.8 metric tons (9.7 tons) of reinforcing steel.</p> <p>In 1980 and 1981, the stack was shortened to 53 m (175 ft). Before demolition, the stack was decontaminated. The rubble was placed inside the remaining portion of the stack (UNI 1984).</p>
<b>Status/History</b>	<p>The reactor stack was designed to discharge ventilation exhausts into the atmosphere from the 105-KW Reactor to prevent the possible buildup of radioactivity near the plant areas.</p> <p>In 1960, following completion of the confinement project, air was diverted through underground concrete ducts to the 117-KW Filter Building. After the air flowed through the filters, it was discharged out the exhaust stack.</p> <p>The 116-KW Reactor Stack is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.</p>
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>Approximately 50 m (165 ft) east of the 105-KW Reactor.</li> <li>Approximately 20 m (66 ft) southeast of 117-KW.</li> </ul>

## Appendix A – Building Descriptions

**Table A-3. 116-KW Reactor Stack. (2 Pages)**

<b>Characterization</b>	<p>In 1976, dose rates at the base of the reactor stack were less than 1 mR/hr (UNI 1978). Before the 1981 demolition, the dose rate at the base of the reactor stack was less than 1 mR/hr. Background radiological levels within the base of the stacks were approximately 1,000 cpm, with low-level smearable alpha contamination present up to 130 dpm/100 cm<sup>2</sup>. Smearable beta contamination ranged from 100 to 5,000 dpm/cm<sup>2</sup>. In 1994, no exterior radiation levels were detected above background.</p>
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dpm = disintegrations per minute

**Table A-4. 117-KW Exhaust Air Filter Building. (2 Pages)**

<b>Name</b>	Exhaust Air Filter Building
<b>Number</b>	117-KW
<b>WIDS Number</b>	100-K-61
<b>Location</b>	East of the 105-KW Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	<p>The facility was constructed almost entirely below grade, with dimensions of 18 x 12 x 10.6 m (59 x 39 x 35 ft) high. The walls were constructed 2.4 m (8 ft) above grade and 8 m (27 ft) below grade. The roof was constructed with a steel frame with large steel hatch covers. Walls were constructed of reinforced concrete with bermed sidewalls of earth and gunite (AEC-GE 1964, PNL 1991, UNI 1984, WHC 1994). The building is 309 m<sup>2</sup> (3,334 ft<sup>2</sup>) (GE 1964).</p> <p>WIDS reports this facility also includes the intake ventilation duct from the 105-KW Building and the exhaust ventilation ducts to the 116-KW Reactor Exhaust Stack (132-KW-1). All ductwork was constructed of concrete 0.3 to 0.6 m (1 to 2 ft) thick.</p> <p>The ventilation ducts are approximately 1.5 m (5 ft) wide by 3.5 m (11.5 ft) high. The 115-KW gas piping tunnel is approximately 11 m (36 ft) wide by 2.4 m (8 ft) high.</p>
<b>Status/History</b>	<p>The 117-KW Exhaust Air Filter Building was constructed as part of the reactor confinement project. The modification filtered ventilation air from the confinement zone of the 105-KW Reactor Building through the 117-KW facility before its discharge into the atmosphere through the 116-KW Reactor Stack.</p> <p>The building housed two identical filter cells with an operating gallery. The facility is divided into two large filter cells separated by a small operating area. The filter cells hold 6 filter frames (two wide and three deep), and were designed to hold 36 filters (0.2 m<sup>2</sup> [2 ft<sup>2</sup>] and 0.3 m [1 ft] thick). The filters were particulate and activated charcoal.</p> <p>The operating area between the two cells is divided into two levels. The upper level (access gallery) has 10 doors that lead from it. Eight doors open into the filter cells and the other two provide access to the intake and exhaust ducts. Below the access gallery is the operating gallery. A sump is located at each end of the operating gallery that was designed to collect incidental drainage from above (WHC 1988).</p>

## Appendix A – Building Descriptions

**Table A-4. 117-KW Exhaust Air Filter Building. (2 Pages)**

	<p>Underground concrete ventilation and gas pipe tunnels extend from the reactor to the 115-KW and 117-KW Buildings and to the reactor stack. The tunnels serve as intake and exhaust plenums to the filter cells.</p> <p>The 117-KW Exhaust Air Filter Building is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.</p>
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 20 m (66 ft) east of the 105-KW Reactor.</li> <li>• Approximately 15 m (50 ft) northwest of 116-KW.</li> </ul>
<b>Characterization</b>	<p>In 1976, radiological readings on the inlet surfaces of the facility was about 20,000 cpm. Dose rates in the inlet tunnel from the 105-KW Building to the 117-KW Building were about 2.5 mR/hr. Dose rates in the exhaust tunnel from the 117 Building to the reactor stack were about 600 cpm.</p> <p>Standard smears collected in the inlet tunnel and filter cells indicate the presence of the following:</p> <ul style="list-style-type: none"> <li>• Inlet tunnel floor upstream of the first turning vane: Sr-90 (<math>4.7 \times 10^2</math> cpm) and C-14 (<math>2.1 \times 10^3</math> cpm)</li> <li>• Inlet tunnel floor at the second turning vane: H-3 (<math>6.5 \times 10^4</math> cpm) and C-14 (<math>4.1 \times 10^4</math> cpm) (UNI 1978).</li> <li>• Filter cells B1 floor (first filter removed): Pu-238 (<math>1.8 \times 10^0</math> cpm), Pu-239/240 (<math>3.7 \times 10^0</math> cpm), Sr-90 (<math>8.6 \times 10^{-1}</math> cpm), Eu-152 (<math>1.5 \times 10^2</math> cpm), Co-60 (<math>4.8 \times 10^3</math> cpm), Eu-154 (<math>4.7 \times 10^3</math> cpm), Cs-137 (<math>6.6 \times 10^2</math> cpm), and Eu-155 (<math>5.1 \times 10^1</math> cpm)</li> <li>• Filter cells wall of B1 filter cell: H-3 (<math>1.5 \times 10^3</math> cpm)</li> <li>• Filter cells charcoal sample from A filter cell (pCi/g): Eu-152 (<math>2.0 \times 10^0</math> cpm), Co-60 (<math>7.7 \times 10^0</math> cpm), Cs-137 (<math>1.0 \times 10^0</math> cpm), and Eu-155 (<math>2.4 \times 10^1</math> cpm).</li> </ul> <p>In 1994, the facility was reported as contaminated. Access to the facility is possible by removing the steel roof hatches with the aid of a crane. Interior equipment remained in place and was contaminated. No exterior radiation levels were detected above background (BHI 1994).</p> <p>WIDS reports that a site walkdown conducted in 1999 indicated the hatch on the top of the above-ground portion of the facility is posted as a "contamination area" and "danger-restricted area, multiple hazards."</p> <p>The ventilation and gas tunnels are contaminated.</p>

**Table A-5. 118-KW-2 Horizontal Control Rod Storage Cave.**

<b>Name</b>	Horizontal Control Rod Storage Cave
<b>Number</b>	118-KW-2
<b>WIDS Number</b>	118-KW-2
<b>Location</b>	Northeast of the 105-KW Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The facility is 2.4 x 18.2 m (8 x 60 ft) and constructed of a concrete slab. Two sections of 60-cm (24-in.)-diameter pipe were cut in half and laid lengthwise (open side down) on the slab, forming a 12-m (40-ft)-long tunnel. Each end of the tunnel contained a concrete vertical wall and steel doors. The tunnel is covered with 1.8 m (6 ft) of fill material. The berm width of fill material is about 7.6 m (25 ft).
<b>Status/History</b>	The 118-KW-2 Horizontal Control Rod Storage Cave was used for temporary storage of irradiated and radioactively contaminated horizontal control rods. The control rods were placed within the tunnel during the temporary storage (WHC 1988, 1994).
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 42 m (140 ft) east of 117-KW.</li> <li>• Approximately 68 m (225 ft) southeast of 150-KW.</li> </ul>
<b>Characterization</b>	The tunnel contains four rod tips and other rod removal components. Radiation reading inside the door is 50 mR/hr.

**Table A-6. 119-KW Exhaust Air Sampling Building.**

<b>Name</b>	Exhaust Air Sampling Building
<b>Number</b>	119-KW
<b>WIDS Number</b>	NA
<b>Location</b>	East of the 105-KW Reactor
<b>Operational Years</b>	1961 to 1971
<b>Building Description</b>	The facility is a small, pre-engineered, ribbed-metal building on a concrete slab foundation. The building's dimensions are 4.2 x 6 m (14 x 20 ft) (UNI 1984, WHC 1994). The door is in the center of the west end, and there are no windows in the building. The interior is painted wallboard. The building is 84.7 m <sup>2</sup> (278 ft <sup>2</sup> ) (GE 1964).
<b>Status/History</b>	<p>The 119-KW Exhaust Air Sampling Building is located over the ventilation ducts that lead to the 117-KW Building. The building was designed to house most of the instrumentation for the exhaust air systems and is located over the ventilation ducts that lead from the filter buildings (PNL 1991).</p> <p>The facility is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.</p>
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 5 m (17 ft) east of the 105-KW Reactor.</li> <li>• Approximately 10 m (33 ft) southwest of 117-KW.</li> </ul>
<b>Characterization</b>	NA

Table A-7. 166-KW Oil Storage Vault.

<b>Name</b>	Oil Storage Vault
<b>Number</b>	166-KW
<b>WIDS Number</b>	130-KW-2
<b>Location</b>	West of the 165-KW Building
<b>Operational Years</b>	1955 to 1970
<b>Building Description</b>	<p>The underground tank was constructed of reinforced concrete and is 42.5 m (139.5 ft) long by 28.5 m (93.6 ft) wide by 7.2 m (23.6 ft) deep. The tanks contained two compartments with a combined capacity of 6,435,200 L (1,700,000 gal). At ground level was a concrete penthouse approximately 3 x 2.4 x 2.4 m (10 x 8 x 8 ft) above a stairwell leading into the pump room (UNI 1984).</p> <p>The building is 1,134.9 m<sup>2</sup> (12,216 ft<sup>2</sup>) (GE 1964). It was constructed with 1,661.6 m<sup>3</sup> (2,172 yd<sup>3</sup>) of concrete; 143.1 metric tons (157.8 tons) of reinforcing steel; 1.8 metric tons (2 tons) of structural steel, 2.8 metric tons (3.1 tons) of miscellaneous steel; and 437.4 lm (1,434 lf) of pipe (AEC 1956).</p>
<b>Status/History</b>	The 166-KW Oil Storage Vault (oil storage building) was designed to provide storage for the fuel oil used in the 165-KW Building. The facility contained one underground oil storage tank located west of the control building, two 170,343-L (45,000-gal) capacity day tanks, and a pump room. Bunker No. 6 fuel oil was stored in the tanks (AEC 1956; WHC 1988, 1994).
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 10 m (33 ft) west of the 165-KW Building.</li> <li>• Approximately 65 m (215 ft) southwest of the 105-KW Building.</li> </ul>
<b>Characterization</b>	<p>In 1976, oil was removed from the 166-KW storage bunkers (WHC 1994).</p> <p>WIDS states that approximately 7,570 L (2,000 gal) of oil remains in the storage tank, and lists the site as hazardous/dangerous.</p>

lf = linear feet

lm = linear meters



Table A-8. 183-KW Chlorine Car Protection Building.

<b>Name</b>	Chlorine Car Protection Building
<b>Number</b>	183-KW
<b>WIDS Number</b>	NA
<b>Location</b>	Next to the 183.1-KW Headhouse
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The 183-KW Chlorine Car Protection Building contained two bays 10.6 m x 29 m x 6.4 m (35 x 96 ft by 21 ft high), with a railroad spur at each bay (WHC 1988). The entry doors are metal and bomb-resistant. Exterior walls are 0.3-m 7.6-cm (1-ft 3-in.)-thick concrete. The center dividing wall is 0.3-m (1-ft)-thick concrete. All three walls extend below grade 0.9 m 10.2 cm (3 ft 4 in.). The roof is 0.3-m 7.6-cm (1-ft 3-in.)-thick concrete, and the floor is 0.3-m 10.2-cm (1-ft 4-in.)-thick concrete. The concrete wall that the entry door is attached to is 0.9 m 2.5 cm (3 ft 1 in.) thick (drawing H-1-25283).
<b>Status/History</b>	The completion report states that chlorine was stored and used directly from railroad tank cars, and air pressure was used for unloading. Chlorine was fed from the railcars to evaporators that vaporized it to a gaseous state. From the evaporators, the chlorine passed to a visible vacuum-type chlorinator that controlled the injection rate in proportion to raw water flow (drawing H-1-25469). The injection of chlorine is blended with raw water to form a chlorine solution. Three evaporators and three chlorinators were used, two for active use and one for standby (AEC 1956).
<b>Proximity to Other Facilities</b>	Next to the 183.1-KW Headhouse.
<b>Characterization</b>	NA

Table A-9. 183.1-KW Headhouse and Tanks.

Name	Headhouse and Tanks																											
Number	183.1-KW Headhouse and Tanks																											
WIDS Number	NA																											
Location	Next to the sedimentation basins at the southern end of the facility																											
Operational Years	1955 to 1971																											
Building Description	<p>The headhouse is the water quality center for the water treatment plant and contained equipment for metering raw water; chemical injection into raw, filtered, and process water; and for effluent and influent control for the filter plant (AEC 1956). The headhouse measured 41.4 x 9.4 x 6 m (136 x 31 x 20 ft) and 21.3 x 18.2 x 6 m (70 x 60 x 20 ft), with a concrete foundation and floor. It also contains structural-steel frame walls with transite siding, and a transite roof with built-up asphalt and gravel (WHC 1988, UNI 1984).</p> <p>The facility was constructed of 2,404 m<sup>3</sup> (3,143 yd<sup>3</sup>) of concrete; 40,274 kg (88,789 lb) of miscellaneous iron; 44,635 kg (98,404 lb) of structural steel; 141,385 kg (311,701 lb) of reinforcing steel; 25.2 metric tons (27.8 tons) of miscellaneous steel; 517 m<sup>2</sup> (5,563 ft<sup>2</sup>) of siding; 2,542.5 lm (8,336 lf) of copper tubing; 6,564.2 lm (21,522 lf) of pipe; 84.5 squares of roofing; and 586 m<sup>2</sup> (6,300 ft<sup>2</sup>) of wallboard and sheetrock (AEC 1956).</p>																											
Status/History	<p>Raw water from the 181-K Pumphouse entered the basement of the headhouse through two 152-cm (60-in.)-diameter pipelines. At the headhouse, the two lines branched into three 91-cm (36-in.)-diameter distribution lines (GE 1952).</p> <p>The headhouse is a single-story, T-shaped structure. The main wing contained the control equipment and personnel facilities; electrical equipment room, main control room, laboratory, lunchroom, locker and restroom, and chlorine equipment room. The remaining portion of the facility housed the sanitary water filters, filter control board, water softeners, caustic soda and alum feeding pumps, activated silica batching and storage tanks, and silica batch control board. The basement of the main wing contained the raw water manifolds, metering stations, and the alum and activated silica injection points. The stem section of the basement contained the chemical heat exchangers, water glycol heat exchangers, circulating pumps, silica batching and storage tanks, and air compressors. The headhouse controlled the operations of the chlorination of raw water, addition of coagulants to raw water, pH correction of filtered water, addition of corrosion inhibitor to process water, and influent and effluent control (AEC 1956, WHC 1988).</p> <p>The facility is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.</p>																											
Proximity to Other Facilities	<ul style="list-style-type: none"><li>• Approximately 66 m (20ft) northeast of 183-KW.</li><li>• Approximately 12 m (40ft) south of 183.2.</li></ul>																											
Characterization	<p>In 1985, a french drain and dry well near the acid tanks at the 183.1-KW Headhouse were identified as having acid sludge containing hazardous inorganic materials. In addition, the drywell contained concentrations of mercury, which classify it as a dangerous waste site. The sludge was residue that was removed from sulfuric acid storage tanks in the late 1960s and early 1970s. Concentrations of inorganic materials from the dry well and french drain are provided below:</p> <table><tr><td>Sample:</td><td>As</td><td>Ba</td><td>Cd</td><td>Cr</td><td>Pb</td><td>Hg</td><td>Ag</td><td>Se</td></tr><tr><td>Dry well sludge:</td><td>0.005</td><td>13.8</td><td>&lt;0.002</td><td>0.03</td><td>0.026</td><td>0.387</td><td>0.05</td><td>0.010</td></tr><tr><td>French drain sludge:</td><td>&lt;0.05</td><td>2.97</td><td>0.002</td><td>0.29</td><td>0.83</td><td>&lt;0.005</td><td>0.07</td><td>0.50</td></tr></table> <p>Source: WHC 1994</p>	Sample:	As	Ba	Cd	Cr	Pb	Hg	Ag	Se	Dry well sludge:	0.005	13.8	<0.002	0.03	0.026	0.387	0.05	0.010	French drain sludge:	<0.05	2.97	0.002	0.29	0.83	<0.005	0.07	0.50
Sample:	As	Ba	Cd	Cr	Pb	Hg	Ag	Se																				
Dry well sludge:	0.005	13.8	<0.002	0.03	0.026	0.387	0.05	0.010																				
French drain sludge:	<0.05	2.97	0.002	0.29	0.83	<0.005	0.07	0.50																				

Table A-10. 183.2-KW Sedimentation Basins.

<b>Name</b>	Sedimentation Basins
<b>Number</b>	183.2-KW
<b>WIDS Number</b>	NA
<b>Location</b>	South of the 105-KW Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	<p>There are six parallel sedimentation basins, each measuring 88.3 m (290 ft) long and 39.6 m (130 ft) wide, and contain 5.1 m (17 ft) of water. Water was fed from the flocculation basins into the sedimentation basins (GE 1952).</p> <p>The basins were constructed with 19,690 m<sup>3</sup> (25,739 yd<sup>3</sup>) of concrete; 18,264 kg (40,266 lb) of miscellaneous iron; 1,328,610 kg (2,929,083 lb) of reinforcing steel; and 4,808.6 m (15,766 ft) of pipe. The water-holding capacity of the sedimentation basins were 106,748,618 L (28,200,000 gal) (AEC 1956). The total area is 26,756 m<sup>2</sup> (288,000 ft<sup>2</sup>) (UNI 1984).</p>
<b>Status/History</b>	<p>The 183.2-KE Flocculation and Sedimentation Basins were designed to provide through-mixing of chemicals that were added to the water in the 183.1-KE Headhouse, coagulation of particles of suspended matter, and settlement of suspended solids. The facility is capable of handling a maximum total water flow of 592,800 L/min (156,000 gal/min). From the headhouse, water entered the flocculation basins and directly into the sedimentation basins. Detention time for the flocculators was 29 minutes to allow for adequate coagulation.</p> <p>The sedimentation basins contained six individual sections, three on each side of a central tunnel, interconnected through two distribution flumes. In addition, each basin discharge flume is equipped with twenty 60-cm (24-in.) disc valves. Water flowed over a weir through the disc valves and into the filter distribution flume located under the discharge flume. At normal water flow, 24.1 cm (9.5 in.) of water flowed over the weir (GE 1952). Water entered the 183.3-KW Filter Plant from the sedimentation basins.</p>
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 11 m (33 ft) north of 183.1-KW.</li> <li>• Approximately 23 m (76 ft) north of 183-KW.</li> </ul>
<b>Characterization</b>	NA

**Table A-11. 183.3-KW Filter Basin.**

<b>Name</b>	Filter Basin
<b>Number</b>	183.3-KW
<b>WIDS Number</b>	NA
<b>Location</b>	North of the 183.2 Sedimentation Basins
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The filter basin is about 246 m (807 ft) wide, 24.6 m (81 ft) long, and 8.5 m (28 ft) high. The basin was constructed of 8,947 m <sup>3</sup> (11,696 yd <sup>3</sup> ) of concrete; 820,231 kg (1,808,300 lb) of reinforcing steel; 6,869.8 lm (22,524 lf) of copper tubing; and 18,370 kg (40,500 lb) of miscellaneous steel (AEC 1956).
<b>Status/History</b>	The 183.3-KW Filter Basin was designed to remove unsettled floc and other small suspended particles carried by the water from the sedimentation basins. The filter building contained three sections: flumes, filters, and pipe gallery. The flumes are a vertical bank of concrete conduits located adjacent to, and paralleling, the entire width of the sedimentation basins. The filters are immediately beyond the flumes and contained two beds and a central gullet separating the beds. Water flowed from the flumes through a 152- and 182-cm (60- and 72-in.) filter sluice gate into each filter gullet. A pipe gallery ran the entire length of the filter, which included the central tunnel. Filtered water flowed from the filters, through the filter effluent flumes toward the outer ends of the flumes, and delivered to the clearwells (183.4-KW).
<b>Proximity to Other Facilities</b>	Immediately north of the 183.3-KW Sedimentation Basins.
<b>Characterization</b>	NA

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**Table A-12. 183.4-KW Reservoir and Clearwells.**

<b>Name</b>	Reservoir and Clearwells
<b>Number</b>	183.4-KW
<b>WIDS Number</b>	NA
<b>Location</b>	North of 183.3-KW
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	<p>The clearwell perimeter walls, floors, columns, beams, and struts were constructed of reinforced concrete. The roof deck was constructed of a pre-cast, reinforced-concrete slab covered with a 4-ply asphalt and gravel.</p> <p>The overall dimensions, which included the central pipe tunnel, are 246.4 m (808.3 ft) long, by 46.7 m (153.3 ft) wide, and 7.3 m (24 ft) deep. Each clearwell is 119.3 m (391.7 ft) long, 46.7 m (153.3 ft) wide, and 7.1 m (23.3 ft) deep. It was constructed of 19,989.6 m<sup>2</sup> (214,942 ft<sup>2</sup>) of concrete; 663.9 metric tons (732 tons) of reinforcing steel; 18.6 metric tons (20.5 tons) of miscellaneous steel; 1,182.5 squares of roofing; 518.5 lm (1,700 lf) of copper tubing; and 1,973.7 lm (6,471 lf) of pipe (AEC 1956).</p>
<b>Status/History</b>	The 183.4-KW Clearwells were designed to provide underground storage of filtered water. The two clearwells are each capable of holding 34,068,708 L (9,000,000 gal) of water (UNI 1984). A pipe tunnel divides the two reservoirs on the centerline. A gravity pipe connection is located between the bottoms of the two halves of the reservoir. The pipe is located under the tunnel, with an overflow line from each reservoir connected to the main sewer.
<b>Proximity to Other Facilities</b>	Approximately 30 m (100 ft) southeast of 166-KW.
<b>Characterization</b>	NA

**Table A-13. 183.5-KW Lime Feeder Building.**

<b>Name</b>	Lime Feeder Building
<b>Number</b>	183.5-KW
<b>WIDS Number</b>	NA
<b>Location</b>	Southwest corner of the 183.4-KW Clearwells
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The lime feeder building is located above the flash mixers. Differences exist in the size of the building. One document says that it is m <sup>2</sup> (225 ft <sup>2</sup> ) (GE 1964), and another document states it is 86 m <sup>2</sup> (925 ft <sup>2</sup> ) (UNI 1984). Construction drawing H-1-25108 indicates the facility was 11 x 8.1 x 5.1 m (36 x 26.8 x 17 ft) tall.
<b>Status/History</b>	The lime feeder building was designed to discharge lime through a pair of flash mixers to the clearwells. Lime was added to the water to obtain the proper pH. The lime building contained an automatic, dry, gravimetric belt-type feeder with a capacity of 226.7 kg/hr (500 lb/hr); hopper, weir box, and lime feeder. Lime was stored in a steel silo with a storage capacity of 113.4 metric tons (125 tons) (AEC 1956). Lime was delivered to the silos by railcars.
<b>Proximity to Other Facilities</b>	Approximately 250 m (825 ft) west of 151-K.
<b>Characterization</b>	NA

**Table A-14. 183.6-KW Lime Feeder Building.**

<b>Name</b>	Lime Feeder Building
<b>Number</b>	183.6-KW
<b>WIDS Number</b>	NA
<b>Location</b>	Southeast corner of the 183.4-KW Clearwells
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The lime feeder building is located above the flash mixers. Differences exist in the size of the building. One document says that it is 21 m <sup>2</sup> (225 ft <sup>2</sup> ) (GE 1964), and another document states it is 86 m <sup>2</sup> (925 ft <sup>2</sup> ) (UNI 1984). Construction drawing H-1-25108 indicates the facility was 11 x 8.1 x 5.1 m (36 x 26.8 x 17 ft) tall.
<b>Status/History</b>	The lime feeder building was designed to discharge lime through a pair of flash mixers to the clearwells. Lime was added to the water to obtain the proper pH. The lime building contained an automatic, dry, gravimetric belt-type feeder with a capacity of 226.7 kg/hr (500 lb/hr); hopper, weir box, and lime feeder. Lime was stored in a steel silo with a storage capacity of 113.4 metric tons (125 tons) (AEC 1956). Lime was delivered to the silos by railcars.
<b>Proximity to Other Facilities</b>	Southeast corner of the 183.4 Clearwells.
<b>Characterization</b>	NA

**Table A-15. 183.7-KW Pipe Tunnel.**

<b>Name</b>	Pipe Tunnel
<b>Number</b>	183.7-KW
<b>WIDS Number</b>	NA
<b>Location</b>	Under the 183-KW Water Treatment Facility
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The pipe tunnel extended from the 183.1-KW Headhouse, under the center of the sedimentation basin, the clearwell fuel storage area, the 190-KW Building, and the 165-KW Building to the 105-KW (AEC 1956, drawing SK-1-23727).
<b>Status/History</b>	
<b>Proximity to Other Facilities</b>	Under the 183-KW Water Treatment Facility.
<b>Characterization</b>	NA

## Appendix A – Building Descriptions

**Table A-16. 190-KW Process Water Pumphouse.**

<b>Name</b>	Process Water Pumphouse
<b>Number</b>	190-KW
<b>WIDS Number</b>	NA
<b>Location</b>	Over the central tunnel between the 165-KW Control Building and 183.4-KW Clearwells
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	<p>The building housed all large water pumping units. The superstructure was constructed of a steel frame and transite siding. The substructure was constructed of reinforced concrete.</p> <p>The facility is 55.4 m (182 ft) wide, 42.7 m (140.3 ft) long, and 9.7 (32 ft) high. The roof is corrugated cement transite with 5-cm (2-in.) form glass insulation and asphalt gravel. The approximate footprint of the facility is 4,425 m<sup>2</sup> (47,634 ft<sup>2</sup>) (GE 1964, WHC 1988).</p> <p>The following materials were used for the construction of the facility: 4,868.5 m<sup>3</sup> (6,364 yd<sup>3</sup>) of concrete; 42 metric tons (46.2 tons) of miscellaneous steel; 377.7 metric tons (416.4 tons) of reinforcing steel; 267.4 metric tons (294.8 tons) of structural steel; 1,508.1 m<sup>2</sup> (16,216 ft<sup>2</sup>) of roofing; 3,749.1 lm (12,292 lf) of siding; 3,749.1 lm (12,292 lf) of pipe; and 1,532.3 lm (5,024 lf) of copper tubing (AEC-GE 1964, AEC 1956, WHC 1994). The building is 4,425 m<sup>2</sup> (47,634 ft<sup>2</sup>) (UNI 1984).</p>
<b>Status/History</b>	<p>The 190-KW Process Water Pumphouse is a single-story building with a basement that was designed to house all large water pumping units, which included service and backwash pumps. The pumphouse developed the pressure necessary to pump treated water to the reactor for cooling (GE 1952). The facility contained six dual-pumping sets of process pumps designed to provide a positive suction head to the secondary pump and also furnish water during transient shutdown. In addition, it contained primary and secondary pumps (GE 1952).</p> <p>The 190-KW Main Pumphouse is eligible for inclusion in the National Register of Historic Places (NPS 1988) as a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District.</p>
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Adjacent to the south wall of the 165-KW Building.</li> <li>• Adjacent to the north wall of the 183.4-KW Clearwells.</li> </ul>
<b>Characterization</b>	NA

Table A-17. 110-KE Gas Storage.

<b>Name</b>	Gas Storage
<b>Number</b>	110-KE
<b>WIDS Number</b>	NA
<b>Location</b>	Northeast of the 115-KE Building
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	This facility contained high-pressure helium tanks that were 60 cm (24 in.) in diameter by 24.3 m (80 ft) long and four large-diameter, low-pressure tanks that were used for carbon dioxide (BHI 1994, UNI 1984, WHC 1994).
<b>Status/History</b>	The 110-KE Gas Storage facility supported the 115-KE Building and is an outdoor unloading and gas storage area. This facility is served by a railroad spur, with associated equipment for transferring gas at high pressure (WHC 1988). The carbon dioxide tanks have been removed, but the supports remain in place.
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 4 m (14 ft) northeast of the 115-KE Building.</li> <li>• Approximately 62 m (205 ft) east of the 105-KE Reactor.</li> </ul>
<b>Characterization</b>	NA

Table A-18. 115-KE Gas Recirculation Building. (2 Pages)

<b>Name</b>	Gas Recirculation Building
<b>Number</b>	115-KE
<b>WIDS Number</b>	NA
<b>Location</b>	East of the 105-KE Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	This single-story building is 6 m (20 ft) above grade and 6 m (20 ft) below grade. It measures 34.4 x 10.3 x 12 m (113 x 34 x 40 ft) tall, with a total area of 360 m <sup>2</sup> (3,880 ft <sup>2</sup> ) (BHI 1994). The building was constructed with a reinforced-concrete foundation and floor and a corrugated transite slab roof with built-up asphalt and gravel (AEC-GE 1964, UNI 1984, WHC 1994).
<b>Status/History</b>	The 115-KE Gas Recirculation Building was designed to house gas circulation pumps, gas dryers, filters, heat exchangers, and related instruments and piping for the reactor gas coolant system (WHC 1988). The building was also designed to detect water leaks within the reactor cores. It contains gas dryer towers, heaters/coolers, condensers, filters, pumps, silica-gel drying beds, piping and ductwork, and heating and ventilation systems. In addition, it contains spindle-type helium storage tanks and a gas unloading room. The equipment was reported present in 1994.
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 23 m (76 ft) east of the 105-KE Reactor.</li> <li>• Approximately 36 m (119 ft) southeast of the 119-KE Building.</li> </ul>



Table A-18. 115-KE Gas Recirculation Building. (2 Pages)

<b>Characterization</b>	<p>In 1976, radiological readings on piping, condensate drains, valves, turbine blowers, and condensers in the dryer rooms were about 10,000 cpm. Radiological readings of the silica-gel towers ranged from 1,000 to 15,000 cpm. The dryer room had the highest radiation level, with radiological readings on the condensers of about 50,000 cpm. Direct readings of the condensers were 30 mR/hr. Background radiation levels were about 1,000 cpm.</p> <p>Dose rates in the filter room were about 1 mR/hr.</p> <p>Dose rates for the gas piping tunnels were about 1 mR/hr. Direct readings of the piping inside the tunnels ranged from 3 to 20 mR/hr.</p> <p>Standard smears taken in 1976 on the gas piping tunnel wall and ball chute and the condensate drains in dryer rooms 1 and 2 indicate the presence of the following:</p> <ul style="list-style-type: none"> <li>• Gas piping tunnel floor: H-3 (<math>5.9 \times 10^2</math> cpm) and Co-60 (<math>3.7 \times 10^1</math> cpm)</li> <li>• Gas piping tunnel wall: Sr-90 (<math>1.6 \times 10^0</math> cpm) and C-14 (<math>5.0 \times 10^2</math> cpm)</li> <li>• Condensate drain in dryer room number 1: H-3 (<math>6.6 \times 10^3</math> cpm) and C-14 (<math>3.3 \times 10^3</math> cpm)</li> <li>• Condensate drain in dryer room number 2: Sr-90 (<math>2.9 \times 10^0</math> cpm) and Co-60 (<math>3 \times 10^1</math> cpm) (UNI 1978).</li> </ul> <p>In 1994, no radiation levels were detected above background around the exterior building perimeter. Interior radiation conditions are anticipated. Interior equipment remained in place and unused due to contaminated conditions.</p>
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Table A-19. 116-KE Reactor Stack. (2 Pages)

<b>Name</b>	Reactor Stack
<b>Number</b>	116-KE
<b>WIDS Number</b>	132-KE-1
<b>Location</b>	East of the 105-KE Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	<p>The 116-KE Reactor Stack was constructed of reinforced concrete and originally 91 m (300 ft) high. It extends 4.8 m (16 ft) below grade and is 4.8 m (16 ft) in diameter. The base wall is 0.45 m (1.5 ft) thick at the base and 0.3 m (1 ft) thick at the top. The base is solid concrete measuring 5.6 m (18.5 ft) side to side, and 3.5 m (11.5 ft) thick, which rests on another concrete base that is octagonal and measures 8.2 m (27 ft) side to side and 1.8 m (6 ft) thick (BHI 1994). The stack contained <math>215.7 \text{ m}^3</math> (282 yd<sup>3</sup>) of concrete and 8.8 metric tons (9.7 tons) of reinforcing steel.</p> <p>In 1980 and 1981, the stack was shortened to 53 m (175 ft). The rubble was placed inside the remaining portion of the stack (UNI 1984).</p>
<b>Status/History</b>	<p>The reactor stack was designed to discharge ventilation exhausts into the atmosphere from the 105-KE Reactor to prevent the possible buildup of radioactivity near the plant areas. In 1960, following the completion of the confinement project, air was diverted through underground concrete ducts to the 117-KW Filter Building. After the air flowed through the filters, it was discharged out the exhaust stack.</p>
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 5 m (17 ft) east of the 105-KE Reactor.</li> <li>• Approximately 23 m (76 ft) northwest of the 115-KE Building.</li> </ul>

**Table A-19. 116-KE Reactor Stack. (2 Pages)**

<b>Characterization</b>	<p>In 1976, dose rates at the base of the reactor stack were less than 1 mR/hr. Samples taken at the 117-KE Inlet Tunnel at the first turning vane upstream of the cells indicate the presence of Pu-238 (<math>2.8 \times 10^{-1}</math> cpm), Pu-239/240 (<math>3.0 \times 10^0</math> cpm), Sr-90 (<math>7.3 \times 10^1</math> cpm), Eu-152 (<math>1.7 \times 10^2</math> cpm), Co-60 (<math>4.4 \times 10^3</math> cpm), and Cs-137 (<math>1.4 \times 10^2</math> cpm) (UNI 1978).</p> <p>In 1994, no exterior radiation levels were detected above background (BHI 1994).</p>
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**Table A-20. 117-KE Exhaust Air Filter Building. (2 Pages)**

<b>Name</b>	Exhaust Air Filter Building
<b>Number</b>	117-KE
<b>WIDS Number</b>	100-K-62
<b>Location</b>	East of the 105-KE Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	<p>The facility was constructed almost entirely below grade (2.4 m [8 ft] above grade and 8 m [27 ft] below grade), with dimensions of 17.9 x 11.8 x 10.6 m (59 x 39 x 35 ft) high (PNL 1991, WHC 1988). The building is 309.7 m<sup>2</sup> (3,334 ft<sup>2</sup>) (GE 1964).</p> <p>The walls are constructed of reinforced concrete. The roof is constructed with a steel frame with large steel hatch covers. The above-grade structure contains bermed sidewalls of reinforced concrete, earth, and gunite (BHI 1994, AEC-GE 1964, UNI 1984, WHC 1994).</p> <p>WIDS reports that this facility also includes the intake ventilation duct from the 105-KW Building and the exhaust ventilation ducts to the 116-KW Reactor Exhaust Stack (132-KE-1). All ductwork was constructed of concrete 0.3 to 0.6 m (1 to 2 ft) thick.</p> <p>Access can only be made by removing the large steel roof hatches with the aid of a crane.</p>
<b>Status/History</b>	<p>The 117-KE Exhaust Air Filter Building was constructed as part of the reactor confinement project. The modification filtered ventilation air from the confinement zone of the 105-KE Reactor Building through the 117-KE facility before its discharge into the atmosphere through the 116-KE Reactor Stack.</p> <p>The building houses two identical filter cells with an operating gallery. The facility is divided into two large filter cells separated by a small operating area. The filter cells hold six filter frames (two wide and three deep) and were designed to hold 36 filters (0.18 m<sup>2</sup> [2 ft<sup>2</sup>] and 0.3 m [1 ft] thick). The filters were particulate and activated charcoal.</p> <p>The operating area between the two cells is divided into two levels. The upper level (access gallery) has 10 doors that lead from it. Eight doors open into the filter cells, and the other two provide access to the intake and exhaust ducts. Below the access gallery is the operating gallery. A sump is located at each end of the operating gallery that was designed to collect incidental drainage from above (WHC 1988).</p> <p>Underground concrete ventilation and gas pipe tunnels extend from the reactor to the 115-KE and 117-KE Buildings, and to the reactor stack. The tunnels serve as intake and exhaust plenums to the filter cells.</p>
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 18 m (60 ft) east of the 105-KE Reactor.</li> <li>• Approximately 37 m (122 ft) north of the 115-KE Building.</li> </ul>

Table A-20. 117-KE Exhaust Air Filter Building. (2 Pages)

<b>Characterization</b>	<p>In 1976, radiological readings on the inlet surfaces of the facility was about 20,000 cpm. Dose rates in the inlet tunnel from the 105-KE Building to the 117-KE Building were about 2.5 mR/hr. Dose rates in the exhaust tunnel from the 117-KE Building to the reactor stack were about 600 cpm.</p> <p>In 1994, no exterior radiation levels were detected above background. The interior of the facility was reported as contaminated. The equipment remained in place (BHI 1994).</p> <p>WIDS reports that a site walkdown conducted in 1999 indicated the hatch on the top of the above-ground portion of the facility is posted as a “contamination area” and “danger-restricted area, multiple hazards.”</p>
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Table A-21. 118-KE-2 Horizontal Control Rod Storage Cave.

<b>Name</b>	Horizontal Control Rod Storage Cave
<b>Number</b>	118-KE-2
<b>WIDS Number</b>	118-KE-2
<b>Location</b>	Northeast of the 105-KE Reactor
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The facility is 2.4 x 18.2 m (8 x 60 ft) and constructed on a concrete slab. Two sections of 60-cm (24-in.)-diameter pipe were cut in half and laid lengthwise (open side down) on the slab, forming a 12-m (40-ft)-long tunnel. Each end of the tunnel contains a concrete vertical wall and steel doors. The tunnels are covered with 1.8 m (6 ft) of fill material. The berm width of fill material is about 7.6 m (25 ft) (WHC 1994).
<b>Status/History</b>	The 118-KE-2 Horizontal Control Rod Storage Cave was used for temporary storage of irradiated and radioactively contaminated horizontal control rods. The control rods were placed within the tunnel during the temporary storage (WHC 1988).
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 18 m (60 ft) northeast of the 117-KE facility.</li> <li>• Approximately 42 m (140 ft) northeast of the 1714-KE Building.</li> </ul>
<b>Characterization</b>	NA

## Appendix A – Building Descriptions

**Table A-22. 166-KE Oil Storage Vault.**

<b>Name</b>	Oil Storage Vault
<b>Number</b>	166-KE
<b>WIDS Number</b>	130-KE-2
<b>Location</b>	Adjacent to the 165-KE Boilerhouse
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The underground tank was constructed of reinforced concrete and was 42.5 m (139.5 ft) long, 28.5 m (93.6 ft) wide, and 7.2 m (23.6 ft) deep. The tanks contain two compartments with a combined capacity of 6,435,200 L (1,700,000 gal). At ground level is a concrete penthouse approximately 3 x 2.4 x 2.4 m (10 x 8 x 8 ft) above a stairwell leading into the pump room. The facility is 1,135 m <sup>2</sup> (12,216 ft <sup>2</sup> ) (GE 1964). It was constructed with 1,735 m <sup>3</sup> (2,268 yd <sup>3</sup> ) of concrete; 143.3 metric tons (158 tons) of reinforcing steel; 0.9 metric tons (1 ton) of structural steel; 2.7 metric tons (3 tons) of miscellaneous steel; 58.6 lm (192 lf) of copper tubing; and 431.1 lm (1,413 lf) of pipe (AEC 1956).
<b>Status/History</b>	The 166-KE Oil Storage Vault (oil storage building) was designed to provide storage for the 165-KE boiler's fuel oil. The facility contains one underground oil storage tank located west of the control building, two 170,343-L (45,000-gal)-capacity day tanks, and a pump room. Bunker No. 6 fuel oil was stored in the tanks (AEC 1956, UNI 1984, WHC 1994). The oil storage vault was later used for the storage of Bunker C oil for the 100-N Area from 1981 to 1985 (WHC 1988).
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 65 m (215 ft) southwest of the 105-KE Reactor.</li> <li>• Approximately 10 m (33 ft) west of the 165-KE Building.</li> </ul>
<b>Characterization</b>	Oil was removed from the 166-KE storage bunker in 1976 (WHC 1994). WIDS reports that approximately 7,570 L (2,000 gal) of oil remains in the concrete tank, and lists the site as hazardous/dangerous.

**Table A-23. 1614-KE Environmental Monitoring Station.**

<b>Name</b>	Environmental Monitoring Station
<b>Number</b>	1614-KE
<b>WIDS Number</b>	NA
<b>Location</b>	Centrally located between the 105-K Reactor buildings
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The building is 6.1 m <sup>2</sup> (66 ft <sup>2</sup> ) (GE 1964). It is constructed of concrete block on a concrete slab. The facility is about 2.4 x 2.4 m (8 x 8 ft). The roof is constructed of tongue-and-groove sheathing with asphalt and gravel covering (drawing H-1-25179).
<b>Status/History</b>	Information related to the status and history of the facility is unavailable.
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• North of the 1717-KE Building.</li> <li>• North of the 1704-KE Building.</li> </ul>
<b>Characterization</b>	NA

**Table A-24. 182-K Emergency Water Pumphouse.**

<b>Name</b>	Emergency Water Pumphouse
<b>Number</b>	182-K
<b>WIDS Number</b>	NA
<b>Location</b>	West of 166-KE
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The facility is 242.4 m <sup>2</sup> (2,610 ft <sup>2</sup> ) and constructed with a steel frame and concrete foundation and floors, transite walls, and roof of insulated steel decking with built-up tar and gravel (BHI 1994, AEC-GE 1964, UNI 1984, WHC 1988). The building is 242.4 m <sup>2</sup> (2,610 ft <sup>2</sup> ) (GE 1964).
<b>Status/History</b>	The 182-K Emergency Water Pumphouse houses diesel engine-driven pumping gear and related equipment for emergency reactor cooling (WHC 1988). The facility was designed to pump water from either the KE or KW Clearwells to either the KE or KW Reactors for emergency cooling (BHI 1994). Two 66,619-L (17,599-gal) steel underground diesel oil storage tanks (2.8 m [9.5 ft] in diameter by 10 m [33 ft] long) were located on the north side of the facility (drawing H-1-23810).
<b>Proximity to Other Facilities</b>	<ul style="list-style-type: none"> <li>• Approximately 45 m (150 ft) west of the 166-KE Building.</li> <li>• Approximately 97 m (320 ft) east of the 1717-K Building.</li> </ul>
<b>Characterization</b>	The tanks were removed in 1993; the soil around the tanks was sampled, results analyzed, and the site backfilled.

**Table A-25. 1701-K Patrol Headquarters.**

<b>Name</b>	Patrol Headquarters
<b>Number</b>	1701-K
<b>WIDS Number</b>	NA
<b>Location</b>	At the southern entrance into the K Reactor area
<b>Operational Years</b>	1968 to ?
<b>Building Description</b>	The dimensions of the building are 14.9 x 15.5 x 4.1 m (49 x 51 x 13.5 ft) high. It is a single-story, concrete and steel-framed structure, which includes corrugated transite walls, concrete foundation and floor, flat pre-fabricated cement board flat roof with built-up asphalt and gravel surfacing. The 1701-K Building adjoins the 1720-K Building, and together the buildings cover approximately 575.9 m <sup>2</sup> (6,200 ft <sup>2</sup> ) (AEC-GE 1964, UNI 1984, WHC 1988). The building is 100.3 m <sup>2</sup> (1,080 ft <sup>2</sup> ) (GE 1964).
<b>Status/History</b>	The 1701-K Patrol Headquarters (badgeline and radio patrol building) is located at the main entrance to the K Reactor area. A portion of the building was used for the telephone exchange and patrol radio rooms, with the remainder of the building containing offices, ordinance room, assembly room, locker room, and other personnel facilities (GE 1952).
<b>Proximity to Other Facilities</b>	Approximately 227 m (750 ft) southeast of the 183.2-KW Sedimentation Basins.
<b>Characterization</b>	NA

**Table A-26. 1720-K Office and Telephone Exchange.**

<b>Name</b>	Office and Telephone Exchange
<b>Number</b>	1720-K
<b>WIDS Number</b>	NA
<b>Location</b>	At the southern entrance into the K Reactor area
<b>Operational Years</b>	1955 to present
<b>Building Description</b>	The 1720-K Building dimensions are 22.5 x 15.2 x 3.9 m (74 x 50 x 13 ft) high. It is constructed as a single-story building, with a concrete and steel-framed structure, which included corrugated transite siding, concrete foundation and floor, cimento board or concrete slab roof with built-up asphalt and gravel (AEC-GE 1964, WHC 1988). The 1701-K Building is 343.7 m <sup>2</sup> (3,700 ft <sup>2</sup> ) and adjoins the 1720-K Building. Together the buildings cover approximately 575.9 m <sup>2</sup> (6,200 ft <sup>2</sup> ) (GE 1964).
<b>Status/History</b>	The 1720-K Office and Telephone Exchange (patrol headquarters and administrative office) was designed to provide facilities for security patrol, duplicating, and mail operations. Portions of the building were used by General Telephone Electric for the telephone exchange (UNI 1984). The 1720-K Building adjoins the 1701-K Building, sharing a common wall.
<b>Proximity to Other Facilities</b>	Approximately 227 m (750 ft) southeast of the 183.2-KW Sedimentation Basins.
<b>Characterization</b>	NA

**Table A-27. 1909-K Effluent Valve Pit.**

<b>Name</b>	Effluent Valve Pit
<b>Number</b>	1909-K
<b>WIDS Number</b>	NA
<b>Location</b>	West wall of KE Reactor and north of the rod rack
<b>Operational Years</b>	1955 to 1971
<b>Building Description</b>	The 1909-K Effluent Valve Pit is believed to be associated with the 1909-KE Junction Box. The junction box is 7.6 m (25 ft) wide by about 4.5 m (15 ft) high (drawing H-1-23227). A 91- and 182-cm (36- and 72-in.)-diameter pipe each enter the north side of the junction box. From the junction box, pipelines enter the west wall of the KE Reactor. The 182-cm (72-in.) pipe rests in concrete saddles that sits on a concrete slab. A 30-cm (12-in.), Schedule 40 stainless-steel bypass line is present near the bend in the pipe west of the reactor wall (drawing H-1-23237).
<b>Status/History</b>	Because both reactors were constructed at the same time with many similarities, there is the possibility that the KW Reactor also contains a 1909 Junction Box (drawing H-1-20365).
<b>Proximity to Other Facilities</b>	Along the west wall of the KE Reactor.
<b>Characterization</b>	NA

**Appendix A – Building Descriptions****Table A-28. Inactive Facilities Included in the 100-K Ancillary Facilities Engineering Evaluation/Cost Analysis.**

<b>Facility</b>	<b>Description</b>	<b>WIDS Number</b>
110-KW	Gas Storage	
115-KW	Gas Recirculation Building	
116-KW	Reactor Stack	132-KW-1
117-KW	Exhaust Air Filter Building	100-K-61
118-KW-2	Horizontal Control Rod Storage Cave	
119-KW	Exhaust Air Sampling Building	
166-KW	Oil Storage Vault	
183-KW	Chlorine Car Protection Building	
183.1-KW	Head House and Tanks	
183.2-KW	Sedimentation Basins	
183.3-KW	Filter Basin	
183.4-KW	Reservoir and Clearwells	
183.5-KW	Lime Feeder Building	
183.6-KW	Lime Feeder Building	
183.7-KW	Pipe Tunnel	
190-KW	Process Water Pumphouse	
110-KE	Gas Storage	
115-KE	Gas Recirculation Building	
116-KE	Reactor Stack	132-KE-1
117-KE	Exhaust Air Filter Building	100-K-62
118-KE-2	Horizontal Control Rod Storage Cave	
166-KE	Oil Storage Vault	
1614-KE	Environmental Monitoring Station	
182-K	Emergency Water Pumphouse	
1701-K	Patrol Headquarters (attached to 1720-K building)	
1720-K	Office and Telephone Exchange	
1909-K	Effluent Valve Pit	

**Table A-29. Facilities Not Included in the 100-K Ancillary Facilities  
Engineering Evaluation/Cost Analysis. (2 Pages)**

Facility	Description	WIDS Number
<i>Active Facilities</i>		
151-KW	Substation 230-KV	
165-KW	Switch Gear, Power Control Building	100-K-66
181-KW	River Pumphouse	
1713-KW	Warehouse	
1714-KW	Oil and Paint Storage Shed	
119-KE	Exhaust Air Sampling Building	
151-KE	Substation 230-KV	
165-KE	Switch Gear, Power Control Building	100-K-67
166A-KE	Material Storage Building	
167-KE	Cross Tie Tunnel	
181-KE	River Pumphouse	
183-KE	Chlorine Car Protection Building	
183.1-KE	Head House and Tanks	
183.2-KE	Sedimentation Basins	
183.3-KE	Filter Basin	
183.4-KE	Reservoir and Clearwells	
183.5-KE	Lime Feeder Building	
183.6-KE	Lime Feeder Building	
183.7-KE	Pipe Tunnel	
190-KE	Process Water Pumphouse	
1705-KE	Effluent Water Treatment Pilot Plant	
1706-KE	Water Studies Semiworks Facility	
1706-KEL	Developmental Laboratory	
1706-KER	Water Studies Recirculation Building	
1713-KE	Shop Building	
1713-KER	Warehouse	
1714-KE	Oil and Paint Storage Shed	
1908-KE	Outfall Instrumentation Building	
142-K	Cold Vacuum Drying Facility	
151-K	Switching Station	
167-K	Cross Tie Tunnel Building	
185-K	Potable Water Plant	
1717-K	Maintenance and Transportation	
1724-K	New Shop Addition	
1724-KA	Storage Facility	
1724-KB	Gas Bottle Storage Facility	
1908-K	Outfall Structure	
<i>Demolished Facilities</i>		
150-KW	Heat Recovery Facility	116-KE-4



**Table A-29. Facilities Not Included in the 100-K Ancillary Facilities  
Engineering Evaluation/Cost Analysis. (2 Pages)**

Facility	Description	WIDS Number
150-KE	Heat Recovery Facility	116-KE-5
1701-KA	Exclusion Area Badge House	
1702-KW	Badge House	
1702-KE	Badge House	
<b><i>Facilities Proposed for Interim Safe Storage Program</i></b>		
105-KW	Reactor Building (includes fuel storage basin)	100-K-43
105-KE	Reactor Building (includes fuel storage basin)	100-K-42
<b><i>Sanitary Sewer Systems</i></b>		
1607-K1	Septic Tank and Associated Drain Field	1607-K1/124-K-1
1607-K2	Septic Tank and Associated Drain Field	1607-K2/124-KE-1
1607-K3	Septic Tank and Associated Drain Field (Inactive)	1607-K3/124-KW-2
1607-K4	Septic Tank and Associated Drain Field (Inactive)	1607-K4/124-K-2
1607-K5	Septic Tank and Associated Drain Field	1607-K5/124-KE-2
1607-K6	Septic Tank and Associated Drain Field	1607-K6/124-KW-1
<b><i>Administrative/Mobile Offices</i></b>		
MO048	Mobile Office	NA
MO054	Mobile Office	NA
MO060	Mobile Office	NA
MO101	Mobile Office	NA
MO102	Mobile Office	NA
MO214	Mobile Office	NA
MO236	Mobile Office	NA
MO237	Mobile Office	NA
MO293	Mobile Office	NA
MO323	Mobile Office	NA
MO382	Mobile Office	NA
MO401	Mobile Office	NA
MO402	Mobile Office	NA
MO420	Mobile Office	NA
MO442	Mobile Office	NA
MO474	Mobile Office	NA
MO495	Mobile Office	NA
MO500	Mobile Office	NA
MO506	Mobile Office	NA
MO507	Mobile Office	NA
MO907	Mobile Office	NA
MO917	Mobile Office	NA
MO928	Mobile Office	NA
MO955	Mobile Office	NA
MO969	Mobile Office	NA

**A.2 REFERENCES**

AEC, 1956, *Completion Report Project CA-512 Volume II 100-K Water Plants*, HW-24800-103, Vol. 2, U.S. Atomic Energy Commission, Richland, Washington.

AEC-GE, 1964, *Hanford Buildings and Facilities 100 Areas*, GEH-26434-100, AEC-GE Study Group, Richland, Washington.

BHI, 1994, *Pre-Existing Conditions Survey of Hanford Site Facilities by Bechtel Hanford, Inc.*, BHI-00221, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

GE, 1952, *100-K Area Water Plant Design*, HW-26414, General Electric Hanford Company, Richland, Washington.

GE, 1964, *100 Area Facilities Listing*, DC-0036, General Electric Hanford Company, Richland, Washington.

NPS, 1988, *The National Register of Historic Places*, National Park Service, U.S. Department of the Interior, Washington, D.C.

PNL, 1991, *Resource Book-Decommissioning of Contaminated Facilities at Hanford*, PNL-7008, Vols. 1 and 3, Pacific Northwest Laboratory, Richland, Washington.

UNI, 1978, *Radiological Characterization of the Retired 100 Areas*, UNI-946, United Nuclear Industries, Inc., Richland, Washington.

UNI, 1984, *100 Deactivated Area Pictorial Review*, UNI-2780, UNC Nuclear Industries, Richland, Washington.

WHC, 1988, *Hanford Surplus Facilities Programs Facilities Listings and Descriptions*, WHC-SP-0331, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994, *100-K Area Technical Baseline Report*, WHC-SD-EN-TI-239, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

**BIBLIOGRAPHY**

DOE-RL, 1992, *Remedial Investigation/Feasibility Study Work Plan for the 100-KR-1 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-20, Draft E, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DUN, 1971, *Reactor Plant Deactivation History 100-KE and K Plant*, DUN-7661, Douglas United Nuclear, Inc., Richland, Washington.



**APPENDIX B**

**DEACTIVATION/DECONTAMINATION AND  
DECOMMISSIONING COSTS**



## **APPENDIX B**

### **DEACTIVATION/DECONTAMINATION AND DECOMMISSIONING COSTS**

#### **B.1 INTRODUCTION**

Current-year cost estimates for deactivation and for decontamination and decommissioning (D&D) were developed for the 27 inactive 100-K Area ancillary facilities included in this engineering evaluation/cost analysis. Deactivation costs include labor, materials, supplies, equipment, subcontractor services, waste disposal costs, overhead, and contingency for each facility. Contingency costs were calculated at 10% and were included in the total costs to address any unforeseen field conditions, delays, and/or uncertainties with the defined work scope. The required deactivation activities and associated costs were estimated by the project engineer for each facility where deactivation had not been completed.

Current-year estimates for D&D include costs for equipment, materials, other direct costs or subcontractor services (including all labor, supplies, equipment, overhead, profit, and bonds), and contingency. Contingency costs were calculated at 10% and were included in the total costs to address any unforeseen field conditions, delays, and/or uncertainties with the defined work scope. The D&D costs were estimated using cost-estimating computer models based on the Micro Computer-Aided Cost Engineering System.

Cost information for deactivation and D&D is presented in Tables B-1 and B-2, respectively.

Table B-1. Deactivation Cost Breakdown. (2 Pages)

Building	Labor Hours			Project Team Burdened Cost								
	Non-manual	Manual	Total	Non-manual	Manual	Material	Subcontracts and Services	Waste	Direct Distrib (18.68%)	G&A (4.98%)	Contingency (10.0 %)	Total
110-KW	24	60	84	\$4,126	\$1,268	\$2,000	NA	NA	\$1,381	\$437	\$921	\$10,134
115-KW	120	640	760	\$44,012	\$6,341	\$10,000	NA	\$20,000	\$15,010	\$4,749	\$10,011	\$110,124
117-KW	24	80	104	\$5,502	\$1,268	\$500	NA	NA	\$1,358	\$430	\$906	\$9,963
118-KW-2	8	16	24	\$1,100	\$423	NA	NA	NA	\$285	\$90	\$190	\$2,087
119-KW	10	24	34	\$1,650	\$528	NA	NA	NA	\$407	\$129	\$271	\$2,986
166-KW	80	1,200	1,280	\$82,523	\$4,227	\$10,000	\$10,000	\$40,000	\$27,413	\$8,673	\$18,284	\$201,121
183-KW	10	40	50	\$2,751	\$528	NA	NA	NA	\$613	\$194	\$409	\$4,494
183.1-KW	60	1,000	1,060	\$68,769	\$3,170	\$10,000	NA	\$20,000	\$19,042	\$6,025	\$12,701	\$139,708
183.7-KW	10	20	30	\$1,375	\$528	NA	NA	NA	\$356	\$113	\$237	\$2,609
190-KW	120	1,200	1,320	\$82,523	\$6,341	\$10,000	NA	\$40,000	\$25,940	\$8,207	\$17,301	\$190,312
110-KE	24	80	104	\$5,502	\$1,268	\$2,000	NA	NA	\$1,638	\$518	\$1,093	\$12,019
115-KE	120	640	760	\$44,012	\$6,341	\$10,000	NA	\$20,000	\$15,010	\$4,749	\$10,011	\$110,124
117-KE	24	80	104	\$5,502	\$1,268	\$500	NA	NA	\$1,358	\$430	\$906	\$9,963
118-KE-2	8	16	24	\$1,100	\$423	NA	NA	NA	\$285	\$90	\$190	\$2,087
166-KE	80	1,200	1,280	\$82,523	\$4,227	\$10,000	\$10,000	\$40,000	\$27,413	\$8,673	\$18,284	\$201,121
182-K	40	480	520	\$33,009	\$2,114	\$5,000	NA	\$30,000	\$13,099	\$4,144	\$8,737	\$96,103
1614-KE	10	40	50	\$2,751	\$528	NA	NA	NA	\$613	\$194	\$409	\$4,494
1701-K	10	40	50	\$2,751	\$528	NA	NA	NA	\$613	\$194	\$409	\$4,494

Table B-1. Deactivation Cost Breakdown. (2 Pages)

Building	Labor Hours			Project Team Burdened Cost								
	Non-manual	Manual	Total	Non-manual	Manual	Material	Subcontracts and Services	Waste	Direct Distrib (18.68%)	G&A (4.98%)	Contingency (10.0 %)	Total
1720-K	40	640	680	\$44,012	\$2,114	\$2,000	NA	\$5,000	\$9,924	\$3,140	\$6,619	\$72,809
1909-K (2 pits)	10	40	50	\$2,751	\$528	NA	NA	NA	\$613	\$194	\$409	\$4,494
<b>Total</b>	<b>832</b>	<b>7,536</b>	<b>8,368</b>	<b>\$518,246</b>	<b>\$43,963</b>	<b>\$72,000</b>	<b>\$20,000</b>	<b>\$215,000</b>	<b>\$162,368</b>	<b>\$51,373</b>	<b>\$108,295</b>	<b>\$1,191,245</b>

NOTE: All costs are in 2004 dollars.  
G&A = general and administrative  
NA = not applicable



Table B-2. Decontamination and Decommissioning Cost Breakdown. (2 Pages)

Building	Costs							Total
	Equipment	Materials	Labor	Other Direct Costs	Direct Distributions (18.68%)	G&A (4.98%)	Contingency (10.00%)	
110-KW	\$4,609	\$2,532	\$121,684	\$23,097	\$28,379	\$8,979	\$18,928	\$208,208
115-KW	\$111,217	\$66,819	\$1,179,655	\$295,111	\$308,743	\$97,685	\$205,923	\$2,265,153
116-KW	NA	\$31,000	\$144,000	\$140,000	NA	NA	\$31,500	\$346,500
117-KW	\$34,422	\$35,553	\$488,245	\$177,243	\$137,385	\$43,468	\$91,632	\$1,007,948
118-KW-2	\$5,966	\$4,920	\$153,593	\$62,319	\$42,366	\$13,404	\$28,257	\$310,825
119-KW	\$5,573	\$4,164	\$150,566	\$60,609	\$41,266	\$13,056	\$27,524	\$302,758
166-KW	\$42,759	\$19,966	\$789,109	\$103,795	\$178,512	\$56,480	\$119,062	\$1,309,683
183-KW	\$14,437	\$8,468	\$247,950	\$90,902	\$67,576	\$21,381	\$45,071	\$495,785
183.1-KW	\$58,130	\$30,677	\$841,484	\$122,617	\$196,683	\$62,230	\$131,182	\$1,443,003
183.2-KW	\$644,381	\$30,806	\$969,675	\$415,129	\$384,806	\$121,751	\$256,655	\$2,823,203
183.3-KW	\$623,683	\$21,658	\$917,668	\$268,922	\$342,204	\$108,272	\$228,241	\$2,510,648
183.4-KW	\$367,986	\$22,950	\$566,829	\$275,196	\$230,317	\$72,871	\$153,615	\$1,689,764
183.5-KW	\$7,252	\$7,638	\$140,022	\$25,238	\$33,652	\$10,647	\$22,445	\$246,894
183.6-KW	\$7,252	\$7,638	\$140,022	\$25,238	\$33,652	\$10,647	\$22,445	\$246,894
183.7-KW	The 183.7-KW facility is an integral part of the 183.2-KW, 183.3-KW, and 183.4-KW facilities and is included in those cost estimates.							NA
190-KW	\$170,046	\$175,604	\$1,451,002	\$194,006	\$371,855	\$117,653	\$248,017	\$2,728,183
110-KE	\$4,609	\$2,532	\$121,684	\$23,097	\$28,379	\$8,979	\$18,927.96	\$208,208
115-KE	\$89,356	\$56,429	\$1,088,910	\$254,410	\$278,165	\$88,010	\$185,528.04	\$2,040,808
116-KE	NA	\$31,000	\$144,000	\$140,000	NA	NA	\$31,500.00	\$346,500
117-KE	\$34,422	\$35,553	\$488,245	\$177,243	\$137,385	\$43,468	\$91,631.63	\$1,007,948
118-KE-2	\$5,966	\$4,920	\$153,593	\$62,319	\$42,366	\$13,404	\$28,256.77	\$310,825

Table B-2. Decontamination and Decommissioning Cost Breakdown. (2 Pages)

Building	Costs							Total
	Equipment	Materials	Labor	Other Direct Costs	Direct Distributions (18.68%)	G&A (4.98%)	Contingency (10.00%)	
166-KE	\$42,759	\$19,966	\$789,109	\$103,795	\$178,512	\$56,480	\$119,062	\$1,309,683
182-K	\$17,575	\$12,563	\$264,535	\$92,603	\$72,343	\$22,889	\$48,251	\$530,759
1614-KE	\$4,541	\$2,338	\$121,116	\$23,079	\$28,221	\$8,929	\$18,822	\$207,046
1701-K	The 1701-K facility is an integral part of the 1720-K facility and is included in that cost estimate.							NA
1720-K	\$18,664	\$18,898	\$710,415	\$94,504	\$157,375	\$49,793	\$104,965	\$1,154,614
1909-K (2 pits)	\$19,711	\$35,889	\$754,898	\$253,846	\$198,819	\$62,906	\$132,607	\$1,458,676
<b>Total</b>	<b>\$2,335,316</b>	<b>\$690,481</b>	<b>\$12,938,009</b>	<b>\$3,504,318</b>	<b>\$3,518,961</b>	<b>\$1,113,382</b>	<b>\$2,410,048</b>	<b>\$26,510,515</b>

NOTE: All costs are in 2004 dollars.

G&A = general and administrative

NA = not applicable



**APPENDIX C**

**APPLICABLE OR RELEVANT AND  
APPROPRIATE REQUIREMENTS**



## ACRONYMS

ACM	asbestos-containing material
ARAR	applicable or relevant and appropriate requirement
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	<i>Code of Federal Regulations</i>
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
LDR	land disposal restriction
PCB	polychlorinated biphenyl
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
S&M	surveillance and maintenance
TBC	to be considered
TSCA	<i>Toxic Substances Control Act of 1976</i>
WAC	<i>Washington Administrative Code</i>



## APPENDIX C

### APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

#### C.1 INTRODUCTION

40 *Code of Federal Regulations* (CFR) 300.415(j) requires that applicable or relevant and appropriate requirements (ARARs) be met (or waived) during the course of removal actions. When requirements are identified, a determination must be made as to whether those requirements are applicable or relevant and appropriate. A requirement is applicable if the specific terms (or jurisdictional prerequisites) of the law or regulations directly address the circumstances at a site. If not applicable, a requirement may nevertheless be relevant and appropriate if (1) circumstances at the site are sufficiently similar to the problems or situations regulated by the requirement; and (2) the use of the requirement is well suited to the site.

To-be-considered (TBC) information is nonpromulgated advisories or guidance issued by federal or state governments that is not legally binding and does not have the status of potential ARARs. The TBCs complement ARARs in determining what is protective at a site or how certain actions should be implemented.

A preliminary assessment has identified the following key ARARs for the alternatives being considered in this document:

- Waste management standards
- Standards controlling releases to the environment
- Environment and health radiological standards
- Cultural, historical, and ecological protection standards.

Other standards that are not environmental standards (and thus not ARARs) but which must be met during implementation of the removal action, or that should be considered, include various U.S. Department of Energy (DOE), federal, and state worker safety standards. Final ARARs and TBCs, which must be complied with during implementation of the selected removal action, will be documented in the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) action memorandum.

#### C.2 COMPLIANCE WITH ARARS

A discussion of how the deactivation/decontamination and decommissioning (D&D) and surveillance and maintenance (S&M) removal action alternatives would comply with the listed preliminary ARARs is provided in the following sections. Where pertinent to the discussion of compliance, TBC items have also been included. The no action alternative is excluded from the discussion because it fails to meet the threshold criterion for overall protection of human health



and the environment, as previously documented in Section 4.0 of this engineering evaluation/cost analysis (EE/CA).

### **C.2.1 Waste Management Standards**

Applicable waste management standards are identified for hazardous/dangerous waste, polychlorinated biphenyl (PCB) waste, radioactive waste, and asbestos in the following subsections.

**C.2.1.1 Hazardous/Dangerous Waste.** Subtitle C of the *Resource Conservation and Recovery Act of 1976* (RCRA) governs the identification, treatment, storage, transportation, and disposal of hazardous waste. The State of Washington has been authorized to enforce most of the Subtitle C provisions. State dangerous waste management regulations promulgated pursuant to this delegated authority and the “Washington Hazardous Waste Management Act of 1976” (*Revised Code of Washington* Chapter 70.105) are codified in accordance with *Washington Administrative Code* (WAC) 173-303 and would be applicable to any dangerous wastes (under the state authority, the term “dangerous waste” is used instead of the term “hazardous waste”) that may be generated under this removal action. The regulations require identifying and appropriately managing dangerous wastes and dangerous components of mixed wastes, as well as identifying associated treatment and disposal standards. Land disposal restrictions (LDRs) established under RCRA (40 CFR 268) prohibit disposal of restricted wastes unless specific concentration- or technology-based treatment standards have been met. The LDRs would be applicable to the treatment and disposal of dangerous or mixed wastes that may be generated during the removal action.

Dangerous and mixed wastes would likely be generated under both alternatives. At this time, it is expected that these wastes would be primarily characteristic dangerous wastes (e.g., lead-contaminated materials). Some listed dangerous wastes (e.g., organic solvents) may also be generated. Both characteristic and listed dangerous or mixed wastes would be designated and managed in accordance with WAC 173-303. The LDRs would be applicable to the treatment and disposal of dangerous or mixed wastes that may be generated during the removal action. Any wastes determined to be dangerous or mixed waste would be treated, as appropriate, to meet the standards of 40 CFR 268 before disposal. For example, lead-contaminated waste could be encapsulated.

After treatment, as appropriate, dangerous and mixed waste that meets acceptance criteria would be disposed at the Environmental Restoration Disposal Facility (ERDF), which is authorized to receive such waste. Any waste that does not meet the *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (BHI 2002) would be staged within the 100-K Area perimeter fence or sent to an onsite dangerous waste storage area meeting the substantive requirements of WAC 173-303 and subsequently disposed at an approved dangerous waste disposal facility. Offsite disposal would require an offsite acceptability determination from the U.S. Environmental Protection Agency (EPA) in accordance with 40 CFR 300.440, with notification to the state in which the offsite facility is located.

**C.2.1.2 Polychlorinated Biphenyl Waste.** The *Toxic Substances Control Act of 1976* (TSCA) (as implemented by 40 CFR 761) regulates the management and disposal of PCBs and PCB waste. PCB-contaminated waste would likely be generated under both alternatives and would be managed in accordance with 40 CFR 761 requirements for PCB remediation waste. The ERDF is authorized to accept nonliquid PCB wastes for disposal. All PCB waste that meets acceptance criteria would be disposed at the ERDF. Any PCB waste that does not meet ERDF waste acceptance criteria (BHI 2002) would be staged within the 100-K Area perimeter fence or sent to an onsite PCB storage area meeting the substantive requirements of TSCA and subsequently transported offsite to an approved TSCA waste disposal facility. Offsite disposal would require an offsite acceptability determination from EPA in accordance with 40 CFR 300.440, with notification to the state in which the offsite facility is located.

**C.2.1.3 Radioactive Waste.** Radioactive wastes are governed under the authority of the *Atomic Energy Act of 1954*. The U.S. Nuclear Regulatory Commission performance objectives for land disposal of low-level radioactive waste are provided in “Licensing Requirements for Land Disposal of Radioactive Waste” (10 CFR 61, Subpart C). Although not applicable to DOE facilities, these standards are relevant and appropriate to any disposal facility that would accept radioactive or mixed waste generated under this removal action. Low-level radioactive waste would be generated under both alternatives being considered for this removal action. Provided that this waste meets the acceptance criteria, it would be disposed at the ERDF, which is authorized to receive low-level waste resulting from CERCLA activities.

**C.2.1.4 Asbestos.** The removal of asbestos and asbestos-containing material (ACM) is regulated under the *Clean Air Act of 1955* (as implemented by 40 CFR 61, Subpart M). These regulations provide standards to ensure that emissions from asbestos are minimized during collection, processing, packaging, and transportation. Handling of asbestos and/or ACM would be required for either of the removal action alternatives. Asbestos and/or ACM would be removed and disposed at the ERDF in accordance with the cited regulations, including appropriate packaging.

## **C.2.2 Transportation**

The *Hazardous Materials Transportation Act of 1974* (as implemented by 49 CFR 100 through 49 CFR 179) governs the transportation of potentially hazardous materials, including samples and waste, on public roads. This regulation is applicable to any wastes or contaminated samples that would be shipped off the Hanford Site. Either alternative could require both onsite and offsite transportation of contaminated waste and potentially contaminated samples. Compliance with this ARAR for onsite transportation of potentially hazardous materials would be met through implementation of DOE orders and federal procedures (e.g., DOE O 460.1A, *Packaging and Transportation Safety*, and EPA’s *Revised Procedures for Planning and Implementing Off-Site Response Actions* [EPA 1987]).

### **C.2.3 Disposal**

The disposal requirements for ERDF and other disposal facilities are presented in the following subsections.

**C.2.3.1 ERDF.** Because both alternatives would include disposal of waste at ERDF, the ERDF waste acceptance criteria (BHI 2002) must be met. The ERDF waste acceptance criteria (which are a TBC item) define radiological, chemical, and physical characteristic criteria for disposal of waste at the facility.

**C.2.3.2 Other Disposal Facilities.** Waste generated during the implementation of either alternative that could not meet, or be treated to meet, the ERDF waste acceptance criteria would be stored or disposed at an alternate Ecology- and EPA-approved facility. Any waste disposal occurring off the Hanford Site would require an offsite acceptability determination by the EPA in accordance with 40 CFR 300.440, with notification to the state in which the offsite facility is located.

### **C.2.4 Standards Controlling Releases to the Environment**

The proposed removal action alternatives have the potential to generate airborne emissions of pollutants. The federal *Clean Air Act* and the “Washington Clean Air Act” (*Revised Code of Washington* Chapter 70.94) regulate both criteria/toxic and radioactive airborne emissions.

Under implementing regulations found in 40 CFR 61.92, radionuclide airborne emissions from all combined operations on the Hanford Site may not exceed 10 mrem/yr effective dose equivalent to the hypothetical maximally exposed individual at the nearest unrestricted area where any member of the public may be. WAC 173-480-070 requires verification of compliance with this standard. Radioactive air emissions are to be controlled through the use of best available radionuclide control technology (WAC 246-247-040[3]) or as low as reasonably achievable control technology (WAC 246-247-040[4]). Emissions of radionuclides are to be measured (40 CFR 61.93 and WAC 246-247-075). Measurement techniques may include, but are not limited to, sampling, calculation, smears, or other reasonable method for identifying emissions as determined by the lead agency. Both alternatives are expected to comply with these standards.

WAC 173-400 and WAC 173-460 establish requirements for emissions of criteria/toxic air pollutants. The primary source of emissions would be fugitive particulate matter. WAC 173-400-040 identifies general standards for control of fugitive emissions resulting from materials handling, construction, demolition, or other operations. Particulate emissions would be controlled through standard industrial practices (reasonable available control technology), including, but not limited to, application of water spray, fixatives, and/or temporary confinement enclosures/glovebag containments. Both alternatives are expected to comply with these standards.

WAC 173-460 may be relevant and appropriate to removal actions that require the use of a treatment technology that emits toxic air pollutants. Treatment of some waste may be required to meet the ERDF waste acceptance criteria prior to disposal for two of the alternatives. In most cases, the type of treatment anticipated would consist of solidification/stabilization techniques such as macroencapsulation or grouting, and WAC 173-460 would not be considered an ARAR. If more aggressive treatment is required that would result in the emission of toxic air pollutants, the substantive requirements of WAC 173-460-030, WAC 173-460-060, and WAC 173-460-070 would be evaluated to determine if they contain relevant and appropriate requirements.

In addition to the ARARs, DOE Order 5400.5 represents a TBC that establishes radiation exposure limits for releases to the public of no greater than 100 mrem/yr effective dose equivalent.

### **C.2.5 Safety and Health Requirements**

Safety and health requirements are not potential ARARs under CERCLA but are included in the discussion for the sake of completeness. The DOE radiation protection standards, limits, and program requirements for protecting workers from ionizing radiation are specified in “Occupational Radiation Protection” (10 CFR 835). The rule also requires that measures be taken to maintain radiation exposures as low as reasonably achievable. In addition, the DOE must meet Occupational Safety and Health Administration requirements for worker protection (e.g., 29 CFR 1910 and 29 CFR 1926), national consensus standards, and DOE orders. Exposure limits, personnel protection requirements, and decontamination methods for hazardous chemicals are established by 29 CFR 1910. Identification and mitigation of physical hazards posed by a facility including (but not limited to) confined spaces, falling hazards, fire, and electrical shock are also required. 29 CFR 1926 provides requirements for worker safety during construction activities. The applicable DOE orders require analysis of hazards posed by work activities and identification of controls necessary to work safely.

Under either alternative, radiological and physical hazards would be identified and analyzed prior to the start of field activities, and appropriate measures for mitigation would be addressed in a task-specific health and safety plan. A combination of personal protective equipment, personnel training, and administrative controls (e.g., limiting time in, and distance from, radiation zones) would be used to ensure that the requirements for worker protection are met. Individual monitoring would be performed, as necessary, to verify compliance with the requirements.

### **C.2.6 Cultural, Historical, and Ecological Resource Protection Requirements**

Requirements associated with archeological remains, human remains, historical artifacts, endangered species, and migratory birds are presented in the following subsections.

**C.2.6.1 Archeological Materials.** The *Archeological and Historic Preservation Act of 1974* provides for the preservation of historical and archeological data (including artifacts) that might be irreparably lost or destroyed as the result of a proposed action. Most of the facilities included

in the scope of this EE/CA are located within the 100-K Area perimeter road, an area that is highly disturbed from past operations. The likelihood of encountering archaeological materials within the footprint of these facilities would be low for either alternative. The likelihood would be greater at facilities located outside the perimeter road (e.g., pumping plants or outfalls) and at borrow sites from which backfill material might be obtained under the deactivation/D&D alternative. Awareness training would be provided to site workers to address this possibility. If archeological materials were discovered, a mitigation plan would be developed in consultation with the appropriate authorities.

**C.2.6.2 Human Remains.** The “Native American Graves Protection and Repatriation Act Regulations” (43 CFR 10) requires agencies to consult and notify culturally affiliated tribes when Native American human remains are inadvertently discovered during project activities. It is unlikely that work proposed in this EE/CA would inadvertently uncover human remains. If human remains were encountered, the procedures documented in the *Hanford Cultural Resources Management Plan* (DOE-RL 2003) would be followed.

**C.2.6.3 Historical Artifacts.** The “Protection of Historic Properties” (36 CFR 800) requires federal agencies to evaluate historic properties for National Register of Historic Places (NPS 1988) eligibility and to mitigate adverse effects of federal activities on any site eligible for listing in the Register. A programmatic agreement that was prepared by DOE specifies how activities at the Hanford Site will comply with the requirements to identify, evaluate, and treat buildings and historic archaeological remains from the Hanford era (DOE-RL 1996). The accompanying treatment plan directs the process for evaluating properties on the Hanford Site and identifies those facilities, including facilities in the 100-K Area, that are contributing facilities recommended for individual documentation (DOE-RL 1998). Appropriate documentation has been completed for the contributing facilities in the 100-K Area. Interior assessments of the 100-K facilities have been conducted to identify and tag artifacts that may have interpretive or educational value. Tagged items would be removed from facilities and transferred to safe storage before any activity that would disrupt such items.

**C.2.6.4 Endangered Species and Migratory Birds.** The *Endangered Species Act of 1973* (as implemented by 50 CFR 402 and WAC 232-012-297) requires the conservation of critical habitat on which endangered or threatened species depend, and prohibits activities that threaten the continued existence of listed species or destruction of critical habitat. The *Migratory Bird Treaty Act of 1918* makes it illegal to remove, capture, or kill any migratory bird or any part of nests or the eggs of any such birds. Although threatened and endangered species are known to be present in the 100 Area, no adverse impacts on protected species or critical habitat resulting from implementation of either alternative would be anticipated because the removal action would be limited to areas highly disturbed from past operations. Potential impacts to biological resources would be of greater concern at borrow sites because they are located in otherwise undisturbed areas. Activity-specific ecological reviews would be conducted to identify potentially adverse impacts before beginning field work.

**C.2.6.5 Floodplains and Wetlands.** The “Compliance with Floodplain/Wetlands Environmental Review Requirements” (10 CFR 1022) mandates that actions performed within a

floodplain be conducted in a manner that avoids adverse effects, minimizes potential harm, and restores and preserves natural and beneficial uses. Some of the facilities in the 100-K Area are located within the Columbia River floodplain and must be managed in accordance with these requirements. However, impacts are expected to be minimal because this removal action focuses on above-ground structures.

### **C.3 REFERENCES**

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," *Code of Federal Regulations*, as amended.

29 CFR 1910, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.

29 CFR 1926, "Safety and Health Regulations for Construction," *Code of Federal Regulations*, as amended.

36 CFR 800, "Protection of Historic Properties," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emissions Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

40 CFR 300, "National Contingency Plan," *Code of Federal Regulations*, as amended.

40 CFR 761, "Polychlorinated Biphenyls (PCBs)," *Code of Federal Regulations*, as amended.

43 CFR 10, "Native American Graves Protection and Repatriation Regulations," *Code of Federal Regulations*, as amended.

49 CFR 100-179, "Transportation," *Code of Federal Regulations*, as amended.

50 CFR 402, "Interagency Cooperation – Endangered Species Act of 1973," *Code of Federal Regulations*, as amended.

*Archeological and Historic Preservation Act of 1974*, 16 U.S.C. 469-469c.

*Atomic Energy Act of 1954*, 42 U.S.C. 2011, et seq.

BHI, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev. 4, Bechtel Hanford, Inc., Richland Washington.

*Clean Air Act of 1955*, 42 U.S.C. 7401, et seq.

*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 U.S.C. 9601, et seq.

DOE O 460.1A, *Packaging and Transportation Safety*, as amended, U.S. Department of Energy, Washington, D.C.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, as amended, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1996, *Programmatic Agreement Among the U.S. Department of Energy, Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington*, DOE/RL-96-77, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998, *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan*, DOE/RL-97-56, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2003, *Hanford Cultural Resources Management Plan*, DOE/RL-98-10, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

*Endangered Species Act of 1973*, 16 U.S.C. 1531, et seq.

EPA, 1987, *Revised Procedures for Planning and Implementing Off-Site Response Actions*, OSWER 9834.11, U.S. Environmental Protection Agency, Washington, D.C.

*Hazardous Materials Transportation Act of 1974*, 49 U.S.C. 1801-1813, et seq.

*Migratory Bird Treaty Act of 1918*, 16 U.S.C. 703, et seq.

NPS, 1988, *The National Register of Historic Places*, National Park Service, U.S. Department of the Interior, Washington, D.C.

*Resource Conservation and Recovery Act of 1976*, 42 U.S.C. 6901, et seq.

RCW 70.94, "Washington Clean Air Act," *Revised Code of Washington* 70.94, as amended.

RCW 70.105, “Washington Hazardous Waste Management Act of 1976,” *Revised Code of Washington* 70.105, as amended.

*Toxic Substances Control Act of 1976*, 15 U.S.C. 2601, et seq.

WAC 173-303, “Dangerous Waste Regulations,” *Washington Administrative Code*, as amended.

WAC 173-400, “General Regulations for Air Pollution Sources,” *Washington Administrative Code*, as amended.

WAC 173-460, “Controls for New Sources of Toxic Air Pollutants,” *Washington Administrative Code*, as amended.

WAC 173-480, “Ambient Air Quality Standards and Emission Limits for Radionuclides,” *Washington Administrative Code*, as amended.

WAC 232-012-297, “Endangered, Threatened, and Sensitive Wildlife Species Classification,” *Washington Administrative Code*, as amended.

WAC 246-247, “Radiation Protection -- Air Emissions,” *Washington Administrative Code*, as amended.

#### **C.4 BIBLIOGRAPHY**

40 CFR 260, “Hazardous Waste Management System: General,” *Code of Federal Regulations*, as amended.

40 CFR 261, “Identification and Listing of Hazardous Waste,” *Code of Federal Regulations*, as amended.

40 CFR 262, “Standards Applicable to Generators of Hazardous Waste,” *Code of Federal Regulations*, as amended.

40 CFR 263, “Standards Applicable to Transporters of Hazardous Waste,” *Code of Federal Regulations*, as amended.

40 CFR 264, “Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,” *Code of Federal Regulations*, as amended.

40 CFR 265, “Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities,” *Code of Federal Regulations*, as amended.

40 CFR 266, “Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities,” *Code of Federal Regulations*, as amended.



40 CFR 300.440, "Procedures for Planning and Implementing Off-Site Response Actions," *Code of Federal Regulations*, as amended.

PNL, 1989, *Hanford Cultural Resources Management Plan*, PNL-6942, Pacific Northwest Laboratory, Richland, Washington.

WAC 296-62, "Department of Labor and Industries," *Washington Administrative Code*, as amended.

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